CANADIAN OCCUPATIONS

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OPTOMETRIST

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MONOGRAPH 11

DEPARTMENT OF LABOUR, OTTAWA

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MONOGRAPH 11

HON. HUMPHREY MITCHELL, MINISTER
ARTHUR MACNAMARA, C.M.G., LL.D., DEPUTY MINISTER

DEPARTMENT OF LABOUR, OTTAWA

45

FOREWORD

During recent years there has been a steadily increasing demand for up-to-date information on occupations.

This demand comes from youth faced with the need of choosing an occupation and of selecting the type of training required; from parents, teachers and other counsellors; from workers shifting to other occupations; from employment service officers; from directors of personnel and union officials, and from other quarters.

This series of monographs and an accompanying series of pamphlets, the latter containing similar information in a condensed form, are attempts to meet this demand.

These publications represent an expansion of an earlier series issued by the Department of Veterans Affairs to assist members of the armed forces returning to civilian life following the end of the war. These current series, designed for general use, cover a wide range of occupations, including professions. They indicate, among other things, the nature of the occupations or group of occupations, entrance and training requirements, working conditions and opportunities in each.

The monographs have been prepared by our research staff working on occupations, with the generous help and advice of officials of the Unemployment Insurance Commission, Vocational Training Branch and Bureau of Technical Personnel of the Department of Labour, Dominion Bureau of Statistics, Provincial Departments of Education and of Labour, employers' associations, trade unions, professional associations, and other government and non-government bodies.

Grateful acknowledgment is made of this assistance and that obtained from numerous publications on occupations prepared in Canada and in other countries.

DIRECTOR,
Economics and Research Branch,
Department of Labour.

March, 1950.

OPTOMETRIST

HISTORY AND IMPORTANCE

Optometry is, as a profession, of recent origin, but derives its beginnings from the introduction of modern scientific methods of physical study of light in the seventeenth century. Though lenses had been used, as aids to failing or defective sight, as early as the 14th century, it was not until Sir Isaac Newton's formulation of the laws of light three centuries later that the techniques of scientific examination of the eye and fitting of lenses could be initiated. The 18th and 19th centuries saw developments in refractive technique which made possible an assured method of diagnosing and compensating visual defects.

Since the surgeon specializing in eye diseases was the only person having professional status in dealing with visual troubles, and since many of these are of a nature not requiring operation or medication, it is not surprising that in many countries the supply of visual aids was largely in the hands of persons, often itinerant pedlars, who sold lenses by a casual "trial and error" method. In towns and cities jewellers and watchmakers handled this business.

At the beginning of the present century legislation to regulate the fitting and making of spectacles was initiated in Minnesota, and in the succeeding quarter-century became general in North America. Three centuries before this a guild of spectacle-makers had been chartered in England.

FIELD OF OPTOMETRY

Three professions are concerned with the care of the human eye.

Oculists or *ophthalmologists* are physicians and surgeons regularly qualified as such, specializing in the diagnosis and treatment of eye diseases, and also using sight-testing equipment and ophthalmic instruments to

detect muscular or structural defects or diseases; they may, and often do prescribe corrective lenses. As surgeons they perform operations when indicated.

Optometrists, not necessarily being graduates in medicine, are restricted to the examination of eyes by sight-testing equipment and ophthalmic instruments, for defects capable of correction by lenses, prisms, or exercises, and to the prescription of the visual aids needed. They may not use drugs, medicine, or surgery.

Some optometrists combine the field of the optician with that of their own profession, for better service to their patients.

Opticians dispense and supply optical goods and supplies. They grind, polish, cut, edge and mount lenses as specified by the prescription of an oculist or an optom-

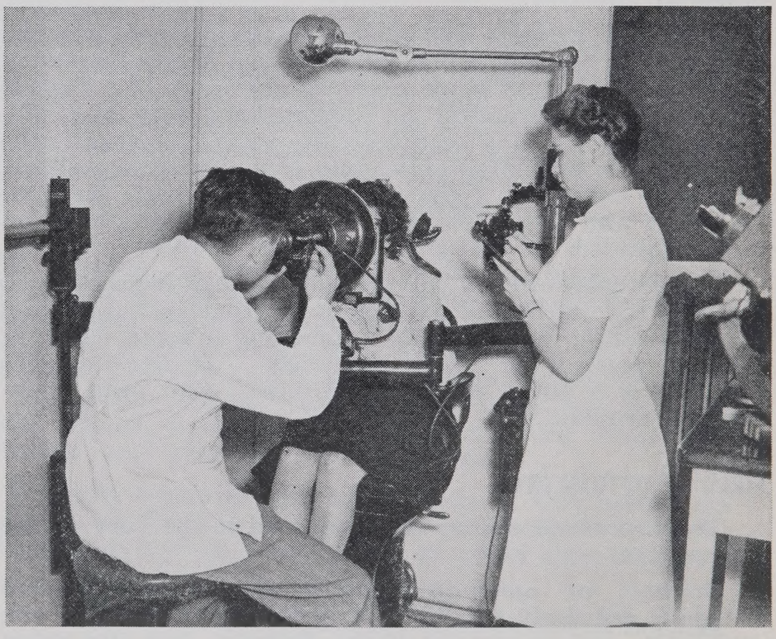

Photo courtesy Ont. College of Optometry

Applied Optometry

etrist. They may not examine or prescribe (unless qualified as optometrists).

Optometrists may be partners or employees of other optometrists or may practise on their own account, in most cases supplying the spectacles, etc., they prescribe. Others may enter the optical departments of departmental or other large stores. In some provinces legislation prohibits this practice, and it is discouraged by all the professional organizations, boards, and colleges.

DUTIES

This profession being standardized in North America, the definition given in the United States Dictionary of Occupational Titles covers the full list of duties:

"Examines eyes, determines their condition, and prescribes treatment to conserve or improve vision without use of medicine, drugs or surgery: determines visual difficulties (refracts) by means of instruments such as ophthalmometer, skiascope and ophthalmoscope; refers patients having ocular manifestations of disease to a medical practitioner; prescribes lenses, prisms or visual training as necessary to correct or improve vision; tests finished lenses to ensure conformance to prescription, using lens-testing machine. May specialize in a particular phase of optometry, such as prescribing and fitting contact lenses and telescopic spectacles, or surveying and correcting visual deficiencies among industrial workers."

Contact lens prescription and fitting, developed since 1938, has special techniques, in some of which a mould is made of the eyeballs while the patient may be under or without anaesthetic. (If anaesthetics are used they have to be administered by a physician). The lenses are made by a limited number of optical factories, to one of which the mould is sent. The optometrist (sometimes the optician) fitting the lenses does minor trimming under the supervision of the oculist or optometrist who prescribes. The lenses while in use require constant lubrication, and the lubricant must be renewed at intervals of from one

to six hours, with the one of about thirty liquids found most suitable to the patient. The lenses are made of plexiglass (a plastic), and research is still being actively carried on to improve these visual aids.

Orthoptics, or prescription of exercises rather than lenses, especially for children, is a branch in which some optometrists specialize.

QUALIFICATIONS

Ability to study, good eyesight, manual dexterity, patience, tact, perseverance, an understanding interest in people, good judgment, orderliness and a good business sense, combined with high ethical standards, are necessary.

This occupation is not restricted to men.

TRAINING

Enrolment is selective, since there are only two colleges providing training for this profession in Canada. The Ontario College of Optometry requires Grade XIII or equivalent. Two years of university completed, may be admitted as equivalent to part of the first year of the course. English speaking students usually attend the Ontario College of Optometry, in Toronto, for a course lasting three years; French-speaking, the Ecole d'Optométrie, University of Montreal. The latter's course is a 4-year one, leading to a Licentiate's degree, and prerequisite is 2nd year arts with Grade XII Science, or equivalent. Holders of a B.A. degree are admitted to the second year. Prospective applicants for the Ontario course are asked to register with the Secretary of the Board of Examiners in the home province before sending in application. This is an essential requirement.

The Toronto diploma is recognized in all provinces except Quebec; the Montreal one in all provinces. Qualifications to practise is dependent on passing the Provincial Board examinations.

Certain schools in the United States provide similar training courses approved by most of the Canadian Provincial Boards. Graduates are allowed to sit for the provincial examinations where this approval is given.

Columbia University and Ohio State College have short post-graduate courses. The Montreal School of Optometry has two-year courses leading to Master's or Doctor's degrees, open to its own Licentiates only.

ENTERING OCCUPATION

After obtaining his diploma, the graduate must pass an examination by the Optometrical Board or Association of the province in which he desires to practise. The Executive and Professional Division of the National Employment Service is available for consultation on placement.

In some provinces a probationary or interim certificate is issued, for the first year, during which the graduate serves, as a rule, with an established optometrist. In Manitoba and Saskatchewan a licence is not granted until after a year's apprenticeship.

Since graduation from the Ontario College is not recognized in Quebec, and since instruction is in French at the University of Montreal, there is very little possibility of those not understanding French practising in Quebec.

Capital required to commence practice is at least $2,000, and possibly $3,000, at present.

EARNINGS

As an employee, an initial salary of about $2,000 a year may be expected. Employment by jewellery and optical firms, department stores, and other outlets of optical goods may be at higher rates, but it is not encouraged by the professional organizations.

Average earnings of "own account" optometrists are estimated as $4,000 per annum in Ontario, with some considerably higher. In the United States in 1945 the

mean net income in the first year was $2,044, in the fifth year $4,060, in the tenth year $5,499, according to a survey by the American Optometric Association. Cities of from 25,000 to 50,000 population yielded the best incomes. Since the occupation is largely an urban one, these figures should be considered in the light of the difference in urbanization of populated areas in Canada as compared with that in the U.S.A.

ADVANCEMENT

The newly licensed optometrist who has obtained employment or apprenticeship with a practitioner may look forward to having his own practice, with increasing income as he establishes a reputation for efficiency, depending on his choice of location. In Canada there is little, if any, employment by industrial concerns.

RELATED OCCUPATIONS

The profession of optician is closely related to that of optometrist, the training being along similar but more limited lines. The two are often combined.

The ophthalmologist, a specializing surgeon, may perform examinations, and prescribe, in the same manner as the optometrist, but his field of duties is much wider in that he diagnoses and treats diseased conditions.

Physicists specializing in the action and properties of light may also be said to follow a related occupation.

ADVANTAGES AND DISADVANTAGES

This profession is one requiring a smaller expenditure of time and money for training than is necessary in the case of physicians, engineers, lawyers, secondary school teachers, and other professional persons who must have university degrees, and in some cases post-graduate study. At the same time its financial returns are at least on a par with those of all these professions for the first

few years, and post-graduate work, though usually advisable, is not essential.

The profession serves an important phase of human health, and relieves the medical profession of much routine examination work, at the same time protecting the public from "trial and error" in the matter of visual aids, and from the ill consequences of the error part. It is thus becoming increasingly respected, and is gaining in importance.

Provincial legislation protects the profession against unqualified competition.

New techniques, such as that of contact lens fitting, add interest to the work.

The occupation is a sheltered one, and hours of work can be regularized.

Disadvantages include the necessity of establishing one's own practice in an untried area, or in competition with others in larger centres. Those who dislike indoor work should avoid optometry. There is only a very moderate future, financially, for employees who remain such, and the initial capital for office and equipment, while not large, may take some years to save.

ORGANIZATIONS

(a) Canadian Association of Optometrists. (Secretary, Edward Bind, 36 St. Clair Ave. West, Toronto.)

(b) The Optometric Association of the various provinces.

(c) The Alumni Associations of the two colleges.

(d) The Optometric Examining Board of each province.

(e) The local regional associations and study groups (13 in Ontario).

TRENDS

Number in Occupation

In 1947 there were 1,320 registered optometrists practising in Canada. This compares with 17,000 in the U.S.A., showing a smaller proportion to population than in that country.

Age Distribution

The *average* age of 1,280 optometrists reported in 1945 was 52. This might indicate that the replacement rate for retirements is likely to exceed that of almost all occupations, but there is no evidence that, in this as in other "sheltered" professions, there is any need for retirement

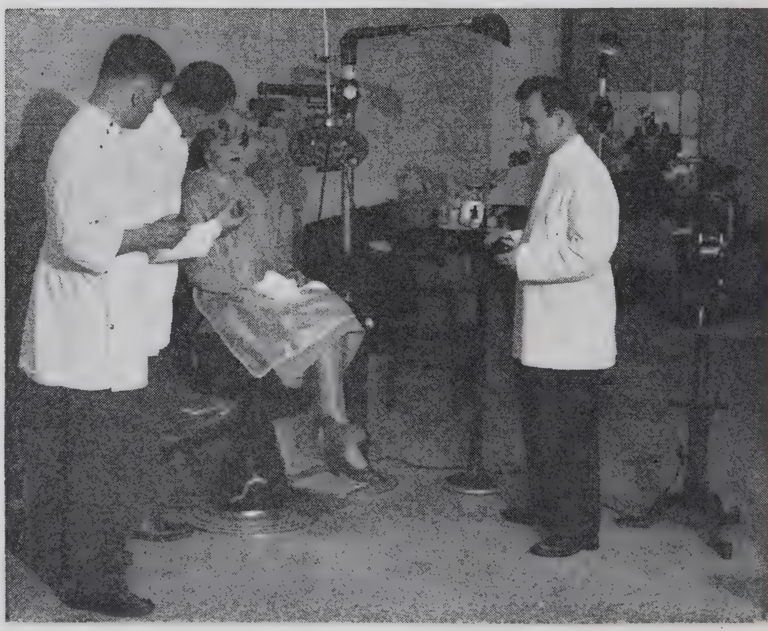

Photo: École d'Optométrie, Montreal

Contact lens fitting

at 55, 65, or even 70 for those in reasonably good health. In one province the average age of the few optometrists is 56, but there is no present demand for replacements.

Sex Distribution

An increasing number of women are entering this profession. In the United States 10 per cent of all students of optometry are women. The proportion of women students in Canada is not great, approximating 2 per cent.

Geographical Distribution

In 1945 over 50 per cent of all optometrists in Canada were in Ontario, and almost a quarter of these in the city of Toronto. Another 20 per cent were in Quebec, 8 per cent in British Columbia, 6 per cent in Alberta and nearly 4 per cent in each of Saskatchewan, Manitoba, Nova Scotia and New Brunswick. The degree of urbanization is a factor governing distribution. A population of 5,000 is deemed necessary for a good living; the general distribution for Canada is about 1 to 8,000, but it is very unbalanced. The strain on the eyes of factory and clerical workers almost certainly makes urban populations a more remunerative field in proportion to numbers than are rural populations. Prince Edward Island, with no large urban centre, has one optometrist to more than 10,000 population, and has little demand for more.

Growth

In the absence of any statistical records, there is no indication that optometry has had any abnormal growth. Actually, its age in the different provinces as an organized profession varies considerably. The limitation of college enrolment in pre-war years to an average of 25 to 30 in Ontario, and 12 to 15 in Quebec, points to an annual intake of possibly 35, or about 3 per cent, to cover retirements, deaths and increase. In an occupation with a normal working life of 35 years this percentage would barely cover retirements alone. The high average age of 52, also, points to a lack of new blood in the past decade or two.

It is thus doubtful if this profession has increased in numbers, at least in the decade or more preceding the war, sufficiently to keep pace with the population increase of 1.1 per cent annually.

There has been no past history of unemployment in this occupation.

Present Demand and Supply

A prominent authority on this profession considered, in 1946, that an annual intake of 50 could be absorbed. The class of 1948 in the Ontario College numbered 89, that of 1949 was 97, the 1950 class has 110. A very large proportion of these are veterans. Registration will be definitely smaller for the course opening in 1950.

In view of the fact that these classes average twice the estimated annual requirements of the profession, the authority quoted considered that too much encouragement should not be given to ex-service men to train for this profession, at least for another two years. It was definitely stated that the province of British Columbia was already fully served by optometrists. A recent report (May 1947) advised that of 15 students from Manitoba at the College of Optometry only 10 had been able to arrange for placement. Quebec is barred to graduates other than those of its own course. In May 1946 a need for 20 was reported from Saskatchewan, for 6 from Alberta.

Inasmuch as this is rather an "own account" than an "employment" occupation, it is not possible to be more specific on present prospects. A graduate who has capital, a connection, ability, a suitable personality and business capacity may well make a success in an area not now served, where one not so equipped might find it difficult to build up a practice.

Future Prospects

The future of this occupation depends on factors not predictable. Professional organizations regard the continent as under-served in the matter of optometry, but this contention is based on a ratio to population rather than an analysis by regions.

Qualifying factors affecting the future

(a) The gradual increase in the proportion of population in the upper age groups, due to greater longevity, undoubtedly will, on a long-term basis, create more demand for visual aids.

(b) The tendency of the medical profession to leave optometry as such to optometrists is increasing. In the United States it is estimated that 75 per cent of this work is now done by optometrists.

(c) Factory work, clerical work, and indoor work of all kinds increase with industrialization, and add to the need for visual adjustments.

(d) The public is beginning to see the advantage of corrective exercises, which optometrists are able to prescribe, for those whose muscular control of eyesight is defective.

(e) The use of contact lenses, when these are made more convenient, will create a greater demand for the services of optometrists. At present these lenses are more or less restricted to persons whose occupations make the employment of obvious visual aids impossible, and who submit to the inconveniences of the contact type for this reason.

Conclusion

The past of optometry as a profession is too short for any clear picture of its future to be made; its present is difficult to evaluate under the existing post-war conditions. Competent authorities see danger of overcrowding in the immediate future. Actually, it appears to be one case in which the individual's choice of location, knowledge, personal qualities and financial resources will determine if there is room for him or not. The field is limited for those not able to practise on their own account.

Counsellors should consult the appropriate professional body in their own provinces as to the situation each year, and ascertain what the prospects for the current graduating class will be in the matter of direct employment, or

apprenticeship where this is required. An occupation so new, and so limited in its numbers in relation to the population as a whole, with its duties still carried on in part by a senior profession, and its usefulness not yet fully known to the public, has yet to achieve full control of its peculiar field of activities. Some people still go to a medical eye specialist for eye testing, and others still buy spectacles at the counter of a "notion" or jeweller's shop. The future depends on the profession itself, its public relations and its efficiency.

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LOCAL INFORMATION

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REVISED 1958

HON. MICHAEL STARR, MINISTER

A. H. BROWN, DEPUTY MINISTER

DEPARTMENT OF LABOUR, CANADA

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FOREWORD

During recent years there has been a steadily increasing demand for Canadian occupational information. This demand comes from youth faced with the need of choosing an occupation and preparing for it; from parents, teachers and vocational guidance counsellors; from workers wishing to change their occupations; from employment service officers; from personnel directors and union officials, and from other quarters.

The "Canadian Occupations" series of monographs is designed to help meet this demand. Each booklet describes, among other things, the nature of the occupation or group of occupations, entrance and training requirements, working conditions and employment outlook.

Occupational information tends to become dated as a result of changes in economic conditions, industrial technology, wage and salary structure, etc. Revision of outdated publications is a regular feature of this series, and space is left in the last few pages of each monograph for recent changes and other local information concerning the occupation.

This series has been prepared with the generous assistance of representatives of management, trade unions, and professional associations. The co-operation of the Unemployment Insurance Commission, the Vocational Training Branch of the Department of Labour, and the Dominion Bureau of Statistics, is gratefully acknowledged.

The research and writing for this monograph was done by Mary E. Stuart under the direction of William Allison, Chief of the Occupational Analysis Section. Grateful acknowledgement is extended to the Canadian Association of Optometrists, the School of Optometry, University of Montreal, and the College of Optometry, Toronto, for their help and co-operation in providing basic textual material.

DIRECTOR,
Economics and Research Branch,
Department of Labour.

February 1958.

OPTOMETRIST

Photo: College of Optometry, Toronto

Optometrists detect, diagnose and correct faulty vision

HISTORY AND IMPORTANCE

Sight is one of man's most precious possessions, and efforts to conserve and improve it have been of utmost concern from early times. The origin of these efforts goes far back to the unknown discoverer of the magnifying qualities of lenses. Written historical records tell us that optical lenses were used as early as the fourteenth century. Charles I of England granted a charter to the "Worshipful Company of Spectacle Makers" in 1629, a privilege that is still in effect. It was not until the nineteenth century, however, that the basic laws of vision were understood, making possible the use of modern techniques in diagnosing and correcting defective vision.

In this twentieth century, the demands upon the eyes by work and recreation are such that very few people go through life

without some vision care. People are living longer, and this too increases the need for new and better vision aids to compensate for failing sight. Early treatment is now considered of primary importance as practitioners in the field gain a better understanding of the problems that arise through poor eyesight.

There are two groups providing professional visual services—Ophthalmologists and Optometrists.

Ophthalmologists (*oculists*) are medical doctors who specialize in the diagnosis and treatment of eye diseases, test vision and prescribe eye glasses and other visual aids.

Optometrists are practitioners who deal broadly with the detection, diagnosis and correction of faulty vision, and are licensed to carry out examination and treatment without the use of drugs and surgery.

A third group, the *opticians*, are skilled craftsmen who grind lenses to the prescription of ophthalmologists and optometrists. Some opticians fit and supply the prescribed eye glasses.

Optometry, which means literally "vision measurement", is a profession of relatively recent origin. The word first appeared in a textbook in 1870, but it was not until about 30 years later that optometry became a specialized vocation. On this continent, the first steps to regulate the profession were taken in 1901 by the State of Minnesota. Soon afterward the provinces of Manitoba and Quebec passed similar legislation and by 1925 all provinces in Canada had taken measures to govern the practice of optometry.

Approximately 1,500 optometrists were practising in Canada in 1957. Of this number, almost 40 per cent were located in Ontario, 25 per cent in Quebec, and 10 per cent in British Columbia. Almost one-quarter of the total number practising in Ontario were residing in Toronto.

FIELDS OF EMPLOYMENT

Most optometrists practise on their own or in partnership with other optometrists. Other fields of employment are in the health divisions of the federal, provincial or municipal governments, departments of education, clinics, the Armed Services, industry (particularly optical manufacturing) and teaching in a school of optometry.

DUTIES

In general, the optometrist examines eyes for visual function and, if necessary, prescribes corrective glasses, subnormal-vision aids, or eye exercises.

The optometrist usually begins his examination by inquiring about the patient's complaints — headaches, eye strain, blurred vision — and also about general health, and the extent to which the eyes are used at work. He looks for any abnormalities in the appearance of the eyes and surrounding structures, notes whether the eyes move together normally as a team and if there is any evidence of squint or cross eyes.

With an *ophthalmoscope*, an instrument which provides a magnified view of the interior of the eye, the optometrist looks for evidence of abnormality or disease. With the *retinoscope*, he measures the amount of refractive error, long sight, short sight or astigmatism (irregular curvature of eye structures).

In testing for clarity of vision, the optometrist has the patient read the familiar eye chart in which the printing becomes progressively smaller. The eyes are tested separately and then both together. Similar testing methods are used for the detection of astigmatism, and other irregularities that prevent proper focusing. The optometrist has the patient look through a series of corrective lenses that are changed and combined until he is satisfied that vision has been corrected as much as possible.

An important part of the examination is a careful check for diseases of the eye. If there is any suggestion of such a condition the patient is referred to an ophthalmologist or to a general medical practitioner, as indicated.

When glasses are needed, the optometrist helps to select the frames that are most comfortable and becoming to the patient. The finished glasses are finally checked and fitted. Some optometrists may employ a technician to make up prescriptions, but the majority have the work done to their specifications by an optical laboratory.

Fields of Specialization

A public awareness of the importance of good vision and the advances in technique that make good vision possible have led some optometrists to specialize in a particular area of the work. This is usually carried on in conjunction with the regular practice

and depends on the local demand for such services and the optometrist's own inclination.

There are a number of persons with poor vision who require special types of eye glasses, including corneal contact lenses (thin lenses that are placed right on the eyes under the eyelids). Contact lenses are of special use when a high degree of correction is necessary, and ordinary glasses would be too thick and heavy. They are also used by very short-sighted athletes who otherwise could not take part in bodily-contact sports. Sometimes actors and public speakers use contact lenses because they think ordinary glasses are unsightly. Optometrists must learn special techniques in order to fit contact lenses that will be comfortable and efficient.

Another specialty of optometrists is the prescribing and fitting of telescopic lenses and other low-vision aids which enable nearly blind persons to see better.

Optometrists practising in an industrial area may specialize in the fitting and designing of special glasses or vision aids for workers carrying on a particular type of work, such as reading of fine print or operating precision machines. They may advise on such matters as industrial safety, problems of factory lighting or, a new area of activity, the best highway design with respect to lighting, rights-of-way, markers and general highway visibility.

Some persons have difficulty in fusing the vision of both eyes into a single picture (binocular vision). In some of these cases *orthoptic* treatment (eye-nerve-muscle exercises) will help to restore normal visual function. Special instruments are used by the optometrist in this form of eye training.

A few optometrists make a particular study of child vision and, along with their practice, may conduct regular vision clinics in schools and public health centres. They may co-operate with welfare workers, doctors and service clubs in assisting underprivileged children who have eye trouble.

WORKING CONDITIONS

Optometrists in practice for themselves are responsible for their own physical working conditions. They may have an office of their own, sometimes in their own home, or they may share a suite in an office building or medical centre. The office, consisting of a waiting room and an examining room, is usually attractive and furnished according to their own tastes.

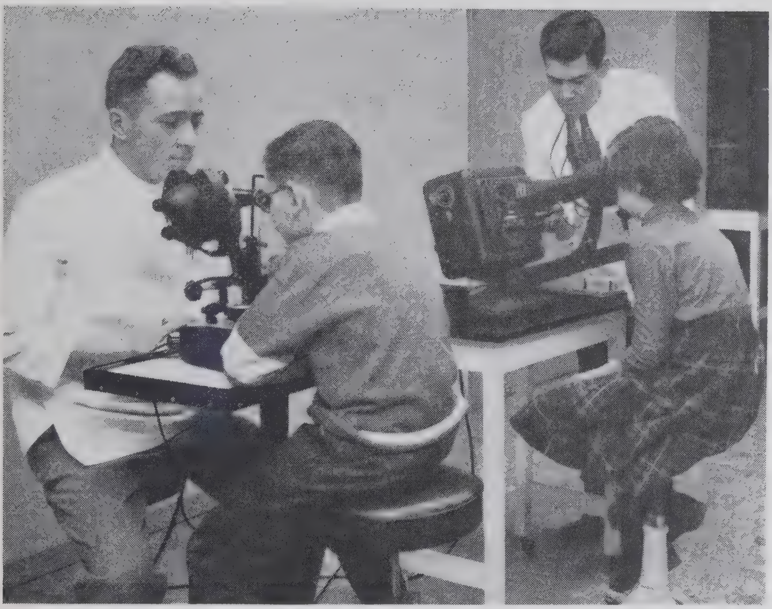

Photo: College of Optometry, Toronto

Some optometrists make a special study of child vision

Examinations are made by appointment and optometrists are able to select hours that best suit their own convenience. This flexibility in working hours allows them to take part in the activities of community and professional organizations. Generally, they work from 9 a.m. to 6 p.m. On occasion, it may be necessary to keep hours outside these in order to accommodate patients. Holidays are sometimes difficult to arrange and in some cases a number of optometrists may plan their vacations so that one is always available to handle emergencies.

Optometrists who are just starting a practice may do their own clerical work — keeping case histories, making appointments, keeping accounts — but as the practice grows they usually employ a receptionist.

The scope and techniques of the occupation are changing rapidly and some time must be spent in keeping abreast of new developments.

PERSONAL QUALIFICATIONS

Optometry deals with the application of science and mathematics to the field of vision, and students considering this work as a career should be interested in, and do well in these subjects. They should also have the intelligence and drive to carry out the study necessary at university, and to keep abreast of scientific developments during their practice.

Most of the work involves contact with people, serving them at a professional level, and therefore tact, patience and high ethical standards are necessary. Meticulous care and accuracy must be exercised in carrying out measurements and calculating prescriptions.

Optometrists do not require great strength to carry out their work, although good health and good hearing are important. People with quite serious physical disabilities have become successful practitioners, and the wearing of glasses is no handicap.

In assessing one's personal suitability for this type of work, it can be useful to discuss the occupation with an optometrist.

PREPARATION AND TRAINING

In Canada there are two colleges providing training leading to a degree in optometry — the College of Optometry, Toronto, and the School of Optometry, University of Montreal. Requirements for entrance and fees vary with each institution. For information beyond that offered below, inquiries should be directed to the Registrar of the school.

> The *College of Optometry*, Toronto, accepts students from all provinces who have at least Grade XIII (Senior Matriculation) or its equivalent. The degree of Doctor of Optometry is granted at the completion of the four-year course. The tuition fee (1957-58) was $410 per annum, and books and equipment, much of which will be used daily after graduation, cost about $80.
>
> The *School of Optometry*, Montreal, offers a three-year course of studies leading to a Licentiate in Optometry. To enter the school, students must have a B.A. degree from either the University of Montreal or Laval University, or two complete years of the Faculty of Science of the University of Montreal or

one recognized by that university. Lectures are in French, but the examinations can be written in English. The tuition fee (1957-58) was $400 per annum, and books and equipment cost approximately $80.

In both schools students follow a course of studies directed to the various aspects of optometry and the operation of their own practice. The course content varies somewhat between the two schools, although the general pattern of theoretical and practical training is the same.

The course includes *Anatomy*, *Neurology*, *Physiology* and *Psychology*, as vision can only be understood when studied in relation to the whole body. *Pathology* as it relates to the eyes is covered in some detail, for optometrists must be able to recognize signs of disease.

In *Applied Optics*, attention is given to the study of the properties of glass and the effect of surface curves, thickness, tilt, prisms, and the many types of lenses designed for specific purposes. In conjunction with applied optics, the study of *Mechanical Optics*, a combined demonstration and laboratory course, covers all phases of dispensing procedure, such as finishing lenses to size, inserting them into suitable frames, and frame adjustment.

Under the subject *Optometry*, students are taught to recognize and measure errors of refraction, using special instruments. They learn to interpret the measurements and to prescribe the eye glasses that will correct or improve vision and to use all types of special low-vision aids for improving the sight of the nearly blind.

Under the title of *Physical* and *Geometrical Optics* students make a study of optical images due to abnormal shape and structure of the eye, and of the measures which can be taken to correct them.

Both schools have clinics where the general public come for eye examinations by the students. The work in these clinics is done under conditions similar to those that will be encountered in actual practice, correlating the theories and techniques of the occupation with actual clinical experience. Instructors closely supervise all the work being done and often give demonstrations or conduct class discussions related to clinic work.

As well as being trained in their chosen profession, students must learn how to be good administrators. Economics, history,

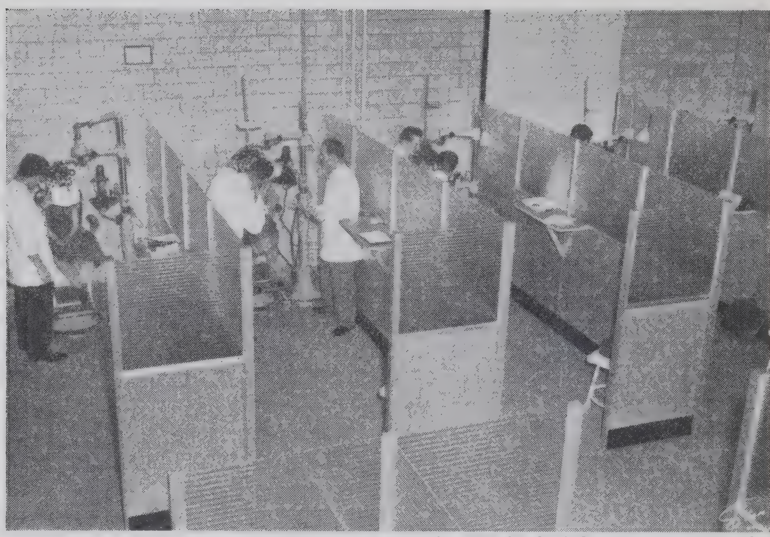

Photo: School of Optometry, Montreal

Students gain experience in school clinics

professional and interprofessional relationships, the Optometry Act and Regulations, ethics, how to operate an office, accounting, and maintaining records, are all topics of study.

Post-Graduate Courses

After a few years in practice, many optometrists arrange to attend a course, or courses, either as a refresher or leading to specialization in a particular area of the work. Some do this post-graduate work in Canada; others study abroad under outstanding world authorities. These courses may last only a few days or months, and can often be fitted into a vacation period.

ENTERING THE OCCUPATION

Before graduate optometrists can practise, they must satisfy the Board of Examiners of the province in which they wish to reside that they are qualified to meet its standards. In Manitoba the newly graduated optometrist must first serve a one-year ap-

Photo: School of Optometry, Montreal

Learning the use of special instruments

prenticeship with a licensed optometrist before entering private practice. Only graduates of the School of Optometry in Montreal are eligible to practise in the Province of Quebec.

The majority of newly graduated and licensed optometrists enter private practice. This may be done by purchasing an established practice from a retiring optometrist or by starting up in a new locality where there is a need for such services.

Capital required to establish an office may be about $3,000, more or less, depending on the place and manner in which the new practitioner begins. Optometrical instruments are quite expensive. It is possible, however, to arrange for budget financing of equipment from supply houses, or good used equipment may be available.

Some graduates first work with an established optometrist, under whom they gain experience, and initial expenses are not as high. Such an association or partnership may lead to ownership when the senior optometrist retires.

Photo: College of Optometry, Toronto

Most optometrists enter private practice

The Executive and Professional Division of the National Employment Service is prepared to give every assistance to those seeking opportunities in this field. Other sources of information are the Deans of the two schools and the provincial associations. The *Canadian Journal of Optometry* often carries announcements of practices that are for sale and of openings for assistants and partners in established offices

Admission of Non-Canadians

The admission of students and graduate optometrists from other countries is governed by specific regulations laid down by the provincial associations. Persons who are considering establishing a practice in Canada should communicate beforehand with the General Manager of the Canadian Association of Optometrists, stating training and experience and the province in which they expect to reside.

EARNINGS

A study made in 1956 showed that the annual earnings of optometrists ranged from $4,000 to $14,000, with an average of approximately $7,000. Many factors enter into the level of earnings — intelligence and ability, personality, general economic conditions, and the ability to make contacts in the community.

The new practitioner may not make very much money during the first year or so. A clientele must be built up on a reputation of service and satisfaction, and equipment must be paid for. Income usually increases steadily for approximately ten years. Once established, the optometrist can look forward to an annual income comparable to that of other professional categories in the health field.

RELATED OCCUPATIONS

Ophthalmologist and optician are the occupations most closely akin to optometrist. Those who decide to become an ophthalmologist must first qualify as a medical doctor.

An optometrist may become a representative of an optical manufacturing concern or may do research work in an optical laboratory. The training is useful to those entering the field of illumination or working as safety directors in industrial corporations.

ADVANTAGES AND DISADVANTAGES

The profession carries the prestige in the community that is common to all health occupations. Because of licensing regulations, practitioners are free from unqualified competition. With the exception of the Province of Quebec, they can practise in any part of Canada by proving to the Examining Board of the province that they can meet its professional requirements. A well conducted practice yields an income that will support a family comfortably.

Optometrists have the satisfaction of working on their own account and of seeing their practice grow in response to their efforts. Although many of the duties are repetitive and confined to an office, each patient is a challenge to the practitioner's skill and an opportunity to serve humanity. Working hours are usually flexible, but arranging vacation periods may be difficult due to patient needs

Professional training is expensive, as many students must live away from home for at least three years and travel long distances to the school. Also, graduates who go into private practice on their own account are faced with a high initial outlay for equipment and slow returns until their practice is established.

WOMEN IN OPTOMETRY

In Canada only about two per cent of the total number of optometrists are women. The actual number is growing, however, as it is realized that this is a field of work in which they can make a worthwhile contribution. Women have proved themselves to be successful in general practice and particularly so in work with pre-school and school-age children, and in community welfare work.

The fact that there is a great measure of freedom in arranging hours to suit their convenience, particularly if they are married, is a consideration. In some cases they work from offices established in their own homes.

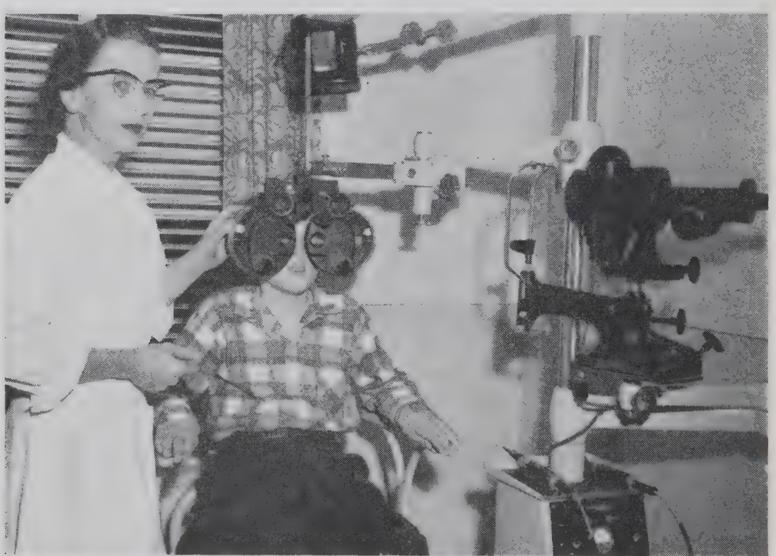

Photo: Lampard & McCrimmon, Red Deer

More women are practising optometry

ORGANIZATIONS

The Canadian Association of Optometrists, with its permanent offices at 32 Front Street West, Toronto, is active on behalf of its membership and publishes a monthly journal, the *Canadian Journal of Optometry*.

Each province has its own optometric association and board of examiners to look after the particular interests of optometrists within the province. In addition, there are regional organizations and study groups.

The alumni associations of the two colleges are active in furthering the well-being of the profession.

TRENDS

The place of the optometrist in the community is now firmly established and the number in the profession in Canada is increasing steadily. The growth, however, has not been sufficient to keep pace with population increase and the demand for vision-care services. There has been no history of unemployment among graduates. Indeed, graduates are usually placed prior to the date of graduation.

It is estimated that a community of 5,000 persons is required to support a successful practice. At the present time, the ratio of optometrists to general population is about 1 to 10,000. This is not a true picture of the situation, however, as the concentration of practitioners, sometimes to the point of overcrowding, is in the older parts of Canada and in the larger cities. New communities are in need of optometrists and offer attractive prospects to the young graduate who wants to become established there. The average age of the present group of optometrists is approximately 50, and it is believed that many in the profession would consider early retirement if younger people were available to carry on their work.

All workers, and in particular factory and clerical workers, have great demands made on their vision. In the past the demand has been, primarily, for corrective lenses, but now has expanded to include specific lenses for special work. Only a start has been made in this area, and optometrists are seeking new answers to the problems of prevention and correction as they arise.

Research in the field of vision is opening up a new approach to many problems — things as basic as a child's trouble in adjustment

to society or poor grades at school; accidents on the highway involving poor visibility; and why certain workers are unable to reach top efficiency on the job. The value of regular examinations for people of all ages, particularly for children starting school and as a pre-employment practice, are gaining public recognition. The proposed Canadian health program should give rise to many opportunities for optometrists.

What of the future for new workers? There is every indication that optometry will be a field of opportunity for many years to come. It offers a promising future, personal satisfaction and a good living for those who complete the required training.

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LOCAL INFORMATION

LOCAL INFORMATION

LOCAL INFORMATION

LOCAL INFORMATION

"CANADIAN OCCUPATIONS" SERIES

Monographs and Pamphlets

The monographs listed below, accompanied by pamphlets, except in the case of numbers 11, 12, 13, 39, 42 and 43, have been published to date.

(1) Carpenter
(2) Bricklayers and Stone-Masons
(3) Plasterer
(4) Painter
(5) Plumber, Pipe Fitter and Steam Fitter
(6) Sheet-Metal Worker
(7) Electrician
(8) Machinist and Machine Operators (Metal)
(9) Printing Trades
(10) Motor Vehicle Mechanic
(11) Optometrist
(12) Social Worker
(13) Lawyer
(14) Mining Occupations
(15) Foundry Workers
(16) Technical Occupations in Radio and Electronics
(17) Forge Shop Occupations
(18) Tool and Die Makers
(19) Railway Careers

Careers in Natural Science and Engineering: (20-35, one booklet)

(20) Agricultural Scientist
(21) Architect
(22) Biologist
(23) Chemist
(24) Geologist
(25) Physicist
(26) Aeronautical Engineer
(27) ——
(28) Chemical Engineer
(29) Civil Engineer
(30) Electrical Engineer
(31) Forest Engineer and Forest Scientist
(32) Mechanical Engineer
(33) Metallurgical Engineer
(34) Mining Engineer
(35) Petroleum Engineer

(36) Hospital Workers (other than Professional)
(37) Draughtsman
(38) Welder
(39) Careers in Home Economics
(40) Occupations in the Aircraft Manufacturing Industry
(41) Careers in Construction
(42) Medical Laboratory Technologist
(43) Careers in Meteorology

Filmstrips

The Department of Labour has prepared, to date, the following occupational filmstrips in collaboration with the National Film Board. A manual has been prepared as an accompaniment to each filmstrip. These may be purchased from the National Film Board, Box 6100, Montreal, or from any one of its regional offices.

Plumber, Pipefitter and Steamfitter
Careers in the Engineering Profession
The Social Worker
Technical Occupations in Radio and Electronics
Bricklayer and Stone-Mason
Printing Trades
Careers in Natural Science
Careers in Home Economics
Motor Vehicle Mechanic
Mining Occupations
Draughtsman
Careers in Construction
Machine Shop Occupations
Sheet-Metal Worker
Careers in Meteorology

DEPARTMENT OF LABOUR

Economics and Research Branch

CANADA, 1958

OTTAWA
EDMOND CLOUTIER, C.M.G., O.A., D.S.P.
QUEEN'S PRINTER AND CONTROLLER OF STATIONERY

Cat. No. L43-1158

CANADIAN OCCUPATIONS

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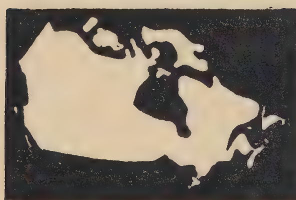
SOCIAL WORKER



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MONOGRAPH 12

DEPARTMENT OF LABOUR, OTTAWA

CANADIAN OCCUPATIONS

★

SOCIAL WORKER

MONOGRAPH 12

HON. MILTON F. GREGG, V.C., MINISTER
ARTHUR MACNAMARA, C.M.G., LL.D., DEPUTY MINISTER

DEPARTMENT OF LABOUR, OTTAWA

45

FOREWORD

During recent years there has been a steadily increasing demand for up-to-date information on occupations.

This demand comes from youth faced with the need of choosing an occupation and of selecting the type of training required, from parents, teachers and other counsellors; from workers shifting to other occupations; from employment service officers; from directors of personnel and union officials, and from other quarters.

This series of monographs and an accompanying series of pamphlets, the latter containing similar information in a condensed form, are attempts to meet this demand.

These publications represent an expansion of an earlier series issued by the Department of Veterans Affairs to assist members of the armed forces returning to civilian life following the end of the war. These current series, designed for general use, cover a wide range of occupations, including professions. They indicate, among other things, the nature of the occupation or group of occupations, entrance and training requirements, working conditions and opportunities in each.

The monographs have been prepared by our research staff working on occupations, with the generous help and advice of officials of the Unemployment Insurance Commission, Vocational Training Branch of the Department of Labour, Dominion Bureau of Statistics, Provincial Departments of Education and of Labour, employers' associations, trade unions, professional associations, and other government and non-government bodies. In the case of the present monograph valuable assistance was also received from the Canadian Association of Social Workers, The Canadian Welfare Council, and the Research Division of the Department of Health and Welfare.

Grateful acknowledgment is made of this assistance and that obtained from numerous publications on occupations prepared in Canada and in other countries.

DIRECTOR,
Economics and Research Branch,
Department of Labour.

March, 1952.

SOCIAL WORKER

HISTORY AND IMPORTANCE

Social work in various forms has been performed since the beginning of history, through the charitable acts of neighbour for neighbour, and later of the community, for the benefit of the less fortunate — the sick, the disabled, the orphan and the widow.

As our economic organization has become increasingly complicated, social problems have increased. Our demands for a rising minimum standard of living for everybody are difficult to obtain; increased knowledge makes medical care more effective, but vastly more expensive; industrial organization may sometimes bring an uncertain pay cheque, unemployment and insecurity; life in cities creates problems of housing, recreation, delinquency and crime; those who are handicapped, by physical or mental conditions, or by age, have to struggle for a living in unequal competition; the strains of present-day conditions cause family conflict, neglected children, and individual breakdown.

Social workers have the task of dealing with these problems. They contribute to the planning and organization of relevant activities in the country and the community, trying to prevent problems from developing and to alleviate the effects of those which have arisen. They are concerned with the administration of welfare services. They work with individuals and groups to help them withstand present-day strains.

Originally social work was the task of the volunteer; it has become the function of community groups and of municipal, provincial and federal governments. As recently as fifty years ago it was the work of kindly, well-intentioned persons; it has become a profession for which intensive training is required.

Photo N.F.B.

"Helping the Handicapped"

FIELD OF SOCIAL WORK

The trained social worker is now a necessity in a field becoming wider and more varied, with greater and more important duties and responsibilities. This field touches and extends into such activities as court work, public assistance, old age pensions, mothers' allowances, family allowances, rehabilitation of veterans, workmen's compensation, unemployment insurance and other social security programmes; it also includes the work in connection with youth organizations, schools, hospitals, child guidance clinics, child protection and care service, and family counselling agencies.

Social work, in its remedial aspect, may be defined as assistance in helping individuals to adapt themselves to the groups and communities in which they must live and work. The adaptation may be of an economic or a psychological nature, and can only be brought about by effecting a change in the circumstances immediately conditioning the individual, by a change in his mental attitude towards them or by a combination of both.

In its preventive aspect, it involves the provision of housing, health, recreation, economic security and family life such as to minimize the development of individual maladjustments. This constructive activity needs legislation to provide the necessary social and economic environment, in most cases, and thus requires the support of large sections of the public.

Specialized types of social work are case work, group work, social planning, administration and research.

Case Work includes: family welfare social work, child welfare, youth guidance, medical social work, public assistance, and psychiatric social work.

Group Work includes: youth serving organizations, community and recreational centres and institutions. This is a method of process which aims at the growth of the individual and the achievement of social goals through group association.

Social Planning includes: developing social and financial resources to meet social needs, and co-ordination of social agencies for the welfare of the community.

Social Administration includes: executive responsibility in public welfare departments, social security programmes and private agencies.

Social Research involves: the study of social problems and practices.

DUTIES

Specific duties of a social worker may vary with the nature of the particular agency, which may be governmental or voluntary, (national, provincial or local) and

Photo N.F.B.

"Playroom in a Day Nursery"

may be organized to administer a social security programme, to work in a specialized field (such as adoption), or as part of a larger organization (such as a hospital).

Case Worker — works with individuals or families, in a public or private agency, through home visits and office interviews. Studies the environmental and personal factors involved in the problem with which the person requires help, and gives assistance through the provision of financial help, the use of medical services, institutions, child placement, etc., and through helping the person to understand his situation more clearly and to use his own strengths to improve it. Determines eligibility for financial assistance or services. Works closely with other community services. Keeps records and writes reports.

Within the casework field are various divisions. In a child welfare agency the worker specializes in the protection and care of children; may work with parents regarding problems affecting the children, arrange for care, and supervise children in foster homes or adoption homes; be responsible for investigating the suitability of such homes; may work with children in day nurseries or institutions, or with their parents.

In a family welfare agency the case worker assists with problems related to the welfare of the family, strengthening the family group in need of help regarding family relationships, unemployment, health, home management, child training, etc.

In a public assistance department the case worker determines the eligibility of a person for financial assistance, and helps him, directly and through the use of community services, to improve his position.

In a juvenile or family court the probation officer investigates cases brought before the court, reports to the judge to help him to administer the appropriate disposition of the case, and provides casework service during the probation period. Other agencies provide service to discharged adult offenders.

The *medical social worker,* in hospitals or clinics, assists the patient and his family in dealing with social and emotional problems related to his illness.

The *psychiatric social worker,* in mental hospitals and child guidance clinics, assists the patient and his family to deal with the social and emotional problems arising from mental illness or emotional maladjustment.

Group Worker — Works with children or adults, in group or mass activities (such as team games, hobbies, dramatics and discussions) with the object of assisting each individual to develop socially; studies each member of the group; plans activities conducive to the attainment of this object; works with members in organizing these activities; visits their homes; trains volunteers; keeps records and writes reports. These workers may be employed in community centres, organizations serving

youth, camps, public recreation programmes and institutions for children.

Supervisor — Occupies a senior position, in both casework and group work agencies, involving some administrative responsibility, and the co-ordination and improvement of the work of other personnel.

Social Planning Worker — Co-ordinates the work of community groups engaged or interested in social welfare in such fields as joint fund-raising, co-operative planning, and the improvement of standards and facilities.

Social Administrator — Administers and makes policy in public and private agencies.

Social Research Worker — May be engaged in any of the above-named areas of welfare work.

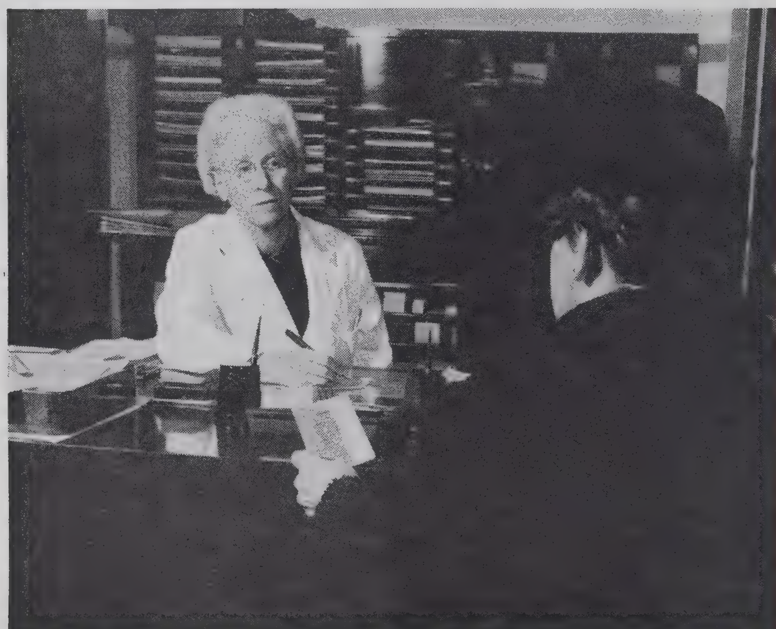

Photo N.F.B.

"Counselling a Convalescent"

QUALIFICATIONS

A person aspiring to be a social worker must have a desire to help those in need of assistance, for their own benefit and that of society; a genuine and objective interest in people and a wish to determine the cause and to understand and neutralize the effect of their problems must be present. Tolerance, tact, sympathy, patience, resourcefulness, self-reliance, a sense of humour, and sound judgment are necessary. There must also be an ability to inspire and retain confidence. A prime requisite is emotional stability, which itself requires physical fitness for its maintenance. A social worker must be a good listener. An orderly mind, capable of planning and organizing, and an ability to accept responsibility and to lead others, are essential in many aspects of this work.

Though many currently engaged in this work have no specialized academic qualifications, the intending social worker should now have a degree in Arts, with concentrated work in the social sciences before applying for a professional course to one of the schools of social work listed below.

TRAINING

In Canada there are eight schools giving professional courses in social work. These courses combine technical theory with field work. Summer short courses in specialized branches are conducted by some of these schools.

A number of scholarships, bursaries and prizes have been established by governments, interested organizations and individuals in an effort to help promising students and thus to increase the number of qualified workers. Several of these grants are for post-graduate work.

Schools of Social Work

The following schools offer courses, the prerequisite being graduation with a Bachelor's degree in Arts covering courses in specified subjects. The degrees of Bachelor of Social Work, after one year, and Master of Social Work after two years, are granted at the first four schools listed;

Laval University offers similar degrees after the second and third year:

(1) School of Social Work, University of Toronto, Toronto.

(2) School of Social Work, University of British Columbia, Vancouver.

(3) School of Social Work, McGill University, Montreal.

(4) School of Social Welfare, St. Patrick's College, Ottawa.

(5) Ecole de Service Social, Université de Montréal, Montreal (bilingual); M.S.S. degree after two years.

(6) Ecole de Service Social, Université Laval (French), Quebec.

(7) Maritime School of Social Work, Box 196, Halifax; Diploma after two years; Master's Degree given by some Maritime Universities after the completion of two years' work.

(8) School of Social Work, University of Manitoba, Winnipeg; one-year course only, leading to B.S.W.

A number of the schools may admit specially qualified persons who are non-graduates. Enrolment is generally selective and prospective students should communicate with the University authorities well ahead of the commencement of the academic year. A personal interview may be necessary.

ENTRY TO PROFESSION

Universities will be in a position to place graduates in contact with employer organizations. The Canadian Association of Social Workers has a placement service.

The Federal Civil Service advertises vacancies from time to time for such departments as National Health and Welfare and Veterans Affairs, as does the Provincial Civil Service in some provinces. Municipal welfare departments also need social workers.

Contacts established during field work on courses lead to entry into professional employment. Hospitals, public welfare departments, the Y.M.C.A. and Y.W.C.A., family and children's agencies, child guidance clinics, and community centres are among the agencies needing social workers. There are temporarily a number of positions of suitable type for those who have no professional qualifications. It has been possible to gain experience in this way prior to formal professional training, but in the near future professional qualifications will be necessary for permanent employment and for advancement. Some agencies employ promising young people in social work, give them a work-study plan, and, on successful performance, educational leave.

EARNINGS

Salaries for qualified graduates range, in government service, from $2,436 to $4,524, according to experience. Salaries vary considerably across the country in the case of other agencies, and no generalization can be made. A few senior positions provide salaries above $5,000.

ADVANCEMENT

The line of advancement in this profession is not well defined, since duties and organizations are not uniform. It will be a matter of individual experience, ability, and opportunity.

As social security legislation becomes more extensive, the fully qualified social worker will find an expanding field in public service with an increasing proportion of administrative appointments in prospect. The extension of both public and other social services has provided opportunity for rapid advancement for persons with ability and proven capacity.

The professional schools are likely to expand their staffs, to provide greater facilities; this may absorb some senior social workers and leave their positions vacant.

Experienced personnel are constantly in demand for the establishment of services in communities which are expanding their social service programmes — family welfare, child welfare, councils of social agencies, etc.

There is a trend toward social service departments in connection with hospitals. At the present time the movement is being hindered by the lack of qualified personnel.

The considerable "turnover" caused by withdrawal of young women from the profession on their marriage, often after some years of experience, is a factor which will enter into opportunities for advancement.

Photo N.F.B.

"Caring for Children of Working Mothers"

RELATED OCCUPATIONS

The very wide range of activities in this classification is naturally related to all educational occupations, since both groups teach individuals and help to adapt them to community life. Certain phases of social service are akin to the work of the Economist, Statistician, Sociologist, Vocational Adviser, Psychiatrist, Nurse, and the Occupational Therapist.

ADVANTAGES AND DISADVANTAGES

Social workers, believing their profession to be a valuable factor in the conservation of individual and community resources, can find satisfaction in their work. The anticipated expansion of the professional field is likely to provide opportunities for economic advancement. The education which the work itself provides ensures a maintenance of interest, and prevents the dissatisfaction which often results from work lacking in variety and progress. There is also, in this relatively uncrowded field, reasonable security of tenure.

A disadvantage is, at present, the comparatively small proportion of positions with remuneration on a professional scale.

ORGANIZATIONS

Canadian Association of Social Workers, 18 Rideau Street, Ottawa

Canadian Welfare Council, 245 Cooper Street, Ottawa.

TRENDS

Number in the Occupation

The profession is a relatively young one in Canada. In 1941 there were 1,805 social workers of all kinds recorded; in 1943 the number was estimated by the two national social service organizations, in a joint submission, at 1,813. The Canadian Association of Social Workers had 1,450 members in June 1951; about 150 qualified persons are said to be non-members.

Sex Distribution

This occupation has always attracted more women than men, and until recently the proportion of the former was increasing. The 1941 census gave 1,253 women to 552 men, or a ratio of 25:11; in 1931 the figures were 792 women to 381 men, a little more than 2:1. Of the professionally trained graduates, 85 per cent have been women. Because of their general familiarity with domestic conditions and interest in the preservation of the family as a unit, women are considered especially adapted for case work. Men formerly predominated in the administrative field; the greater upper age-group proportion of men shown below may partly account for this. There is a greater number of men at present in schools than ever before; three of the largest Canadian schools report that men constituted 50 per cent of the total enrolment in 1948.

Age Groups

As a result of the comparatively recent placing of this occupation on a professional basis, there is no abnormal proportion of social workers in the upper-age brackets. In 1941, the percentage aged 55 and over was 25 for men, 16 for women, 18 for all. This corresponds with the average for all occupations at that time.

Geographical Distribution

Social Service has been much more fully provided in industrial areas of concentrated population. Thus British Columbia had in 1941 as many (207) social workers as the three Prairie Provinces together, and the Maritimes, with a population of somewhat greater than that of the Pacific province, had only 75. Quebec, with 458, and Ontario, with 855, also indicate the urban tendency; the former has probably, in addition, a number of practical welfare workers, classified as members of religious orders in the census. The demand for workers in rural areas, particularly by provincial welfare departments and child welfare agencies, is increasing.

Growth

Before 1931 the census classified members of religious orders and social workers under one head. In 1931 social

workers recorded numbered 1,173; in 1941 they were 1,805. This increase, amounting to 54 per cent, contrasts with one of about 11 per cent for the whole population. It can be associated with the growth of public consciousness of social responsibility, with the acute conditions arising from the economic circumstances prevailing in the 1930's, and with the improvement of professional status resulting from special educational facilities.

Regularity of Employment

Unemployment in this profession is not a problem. Since in the time of economic distress the social worker was most needed, and since in the present period of "full employment" the supply of trained personnel is inadequate, it does not appear likely that there will be any surplus of such persons for some years to come. Another business recession is likely to reveal a greater need for their services than ever.

Present Demand and Supply

Surveys during recent years indicate a shortage of at least 500 trained social workers in Canada. The increase in social security legislation, the greater recognition of the need for trained workers, and the continual pressure to improve standards have all added to the demand. On the supply side some 67 graduated from the various schools of social work with the degree of Bachelor in 1950; another 252 received Master's degrees; 88 received two-year certificates and 20 one-year certificates. The enrolment of full-time students in 1950-1 was 527, of whom 325 were in the first year, and 202 in the second year.

The following is an excerpt from a memorandum to the Minister of National Health and Welfare from the National Committee of Canadian Schools of Social Work, dated November 23, 1949:

> "The shortage of professionally trained social workers is still acute. Dominion departments, provincial and local agencies, and private organizations still have difficulty in recruiting enough properly trained social workers . . . All the Schools report that they were unable to meet many requests for per-

sonnel which came to them from public and private agencies . . . Available evidence indicates that, even without the adoption of new social security measures by the Dominion Government in co-operation with the provinces, the Schools will continue to be unable, for some years to come, to meet personnel demands.

"Better trained graduates, including specialists in various areas, are much needed. Many students are now leaving the Schools at the end of one year of graduate work, attracted by the numerous opportunities of work which exist. Larger numbers should be encouraged to spend the full two years in the Schools so as to become better qualified for future positions as supervisors, consultants, executives, and specialists of various kinds."

Qualifying Factors affecting Future Employment

The present time is one in which several factors contribute to make the need for social workers an acute one.

(a) Social Security legislation, such as Unemployment Insurance, Family Allowances, Mothers' Allowances, and War Veterans' Allowances, creates a necessity for competent investigators and advisers. In some cases, as in the Department of Veterans Affairs, social service divisions have been set up.

(b) The current preparedness programme and civil defence organization create problems needing professional handling.

(c) Organizations formerly using unqualified staffs are becoming increasingly convinced of the necessity for fully qualified workers.

(d) The growing tendency to establish recreation centres under municipal control creates a demand for social workers specializing in this type of activity.

(e) Increasing urbanization, inadequate housing, the seasonal nature of much unskilled work, the increase in domestic problems resulting from war stress, and changing ethical standards all tend to increase the need for persons who can deal with the resulting problems in a dispassionate, objective and constructive manner. This

is creating a trend towards the handling of such matters by public authorities, but the work of private organizations is also expanding.

(f) Any increase in population, such as that brought by immigration, will create a proportional increase in the demand for social workers.

Summary

There is likely to be ample opportunity for an increasing number of graduates in this profession for an indefinite number of years. There is also a probability that a considerable but diminishing number of non-professional social workers will continue to be employed. Advancement will be very limited for those who do not take professional courses; for those who do, the field is a wide one with improving opportunities and remuneration.

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LOCAL INFORMATION

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"CANADIAN OCCUPATIONS" SERIES

The monographs listed below, accompanied by pamphlets, except in the case of numbers 13 and 20-35, have been published to date. Those from 20-25 have been published collectively.

(1) *Carpenter*

(2) *Bricklayers and Stone-Masons*

(3) *Plasterer*

(4) *Painter*

(5) *Plumber, Pipe Fitter and Steam Fitter*

(6) *Sheet-Metal Worker*

(7) *Electrician*

(8) *Machinist and Machine Operators (Metal)*

(9) *Printing Trades*

(10) *Motor Vehicle Mechanic and Repairman*

(11) *Optometrist*

(12) *Social Worker*

(13) *Lawyer*

(14) *Mining Occupations*

(15) *Foundry Workers*

(16) *Technical Occupations in Radio and Electronics*

Careers in Natural Science and Engineering: (20-35)

(20) "Agricultural Scientist"

(21) "Architect"

(22) "Biologist"

(23) "Chemist"

(24) "Geologist"

(25) "Physicist"

(26) "Aeronautical Engineer"

(27) "Ceramic Engineer"

(28) "Chemical Engineer"

(29) "Civil Engineer"

(30) "Electrical Engineer"

(31) "Forest Engineer and Forest Scientists"

(32) "Mechanical Engineer"

(33) "Metallurgical Engineer"

(34) "Mining Engineer"

(35) "Petroleum Engineer"

DEPARTMENT OF LABOUR

Economics and Research Branch

OTTAWA, 1952

OTTAWA
EDMOND CLOUTIER, C.M.G., O.A., D.S.P.,
QUEEN'S PRINTER AND CONTROLLER OF STATIONERY

CANADIAN OCCUPATIONS

★

SOCIAL WORKER

★

MONOGRAPH 12

REVISED 1957

DEPARTMENT OF LABOUR, CANADA

All monographs in the "Canadian Occupations" series are priced at 10 cents per copy, with the exception of *Careers in Natural Science and Engineering*, which is 25 cents. A discount of 25 per cent is allowed on quantities of 100 or more.

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CANADIAN OCCUPATIONS

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SOCIAL WORKER

MONOGRAPH 12

REVISED 1957

HON. MICHAEL STARR, MINISTER

A. H. BROWN, DEPUTY MINISTER

DEPARTMENT OF LABOUR, CANADA

45

Price: 10 cents

FOREWORD

During recent years there has been a steadily increasing demand for up-to-date information on occupations.

This demand comes from youth faced with the need of choosing an occupation and of selecting the type of training required; from parents, teachers and other counsellors; from workers shifting to other occupations; from employment service officers; from directors of personnel and union officials, and from other quarters.

This series of monographs and an accompanying series of pamphlets, the latter containing similar information in a condensed form, are attempts to meet this demand. These publications are designed for general use and cover a wide range of occupations, including professions. They indicate, among other things, the nature of the occupation or group of occupations, entrance and training requirements, working conditions and opportunities in each.

The staff of the Occupational Analysis Section has prepared this series with the generous assistance of representatives of management, trade unions, and professional associations. The co-operation of the Unemployment Insurance Commission, the Vocational Training Branch of the Department of Labour, and the Dominion Bureau of Statistics is gratefully acknowledged.

Acknowledgment is also made of the assistance obtained from numerous publications on occupations prepared in Canada and in other countries.

DIRECTOR,
Economics and Research Branch,
Department of Labour.

July 1957.

CONTENTS

	page
HISTORY AND IMPORTANCE	4
SOCIAL WORK IN CANADA	5
FIELDS OF WORK	6
Family Welfare	6
Child Welfare	6
Medical Social Work	7
Psychiatric Social Work	8
Public Assistance and Social Security	8
Probation and Parole Work	8
Other Fields	9
NATURE OF THE WORK	9
Casework	10
Group Work	10
Community Organization	10
Administration	11
Research	11
QUALIFICATIONS	11
PREPARATION AND TRAINING	13
Postgraduate Education	13
Schools of Social Work	13
Student Assistance	14
In-Service Training	14
ENTRY INTO THE PROFESSION	15
EARNINGS	15
ADVANCEMENT	16
RELATED OCCUPATIONS	16
ADVANTAGES AND DISADVANTAGES	16
ORGANIZATIONS	17
TRENDS	17
Number in Occupation	17
Geographical Distribution	19
Growth	19
Present Demand and Supply	19
Outlook	20
REFERENCES	20

SOCIAL WORKER

Photo : N.F.B.

Social service is carried out by trained workers.

HISTORY AND IMPORTANCE

Social work as a profession is relatively young, although its principles and practice have been carried on for centuries by religious and philanthropic groups or individuals interested in human welfare and happiness.

Years ago, when hardship and tragedy struck, friends and relatives would very often come to help in a spirit of neighborliness. As society became more complex and impersonal, such informal charity and help became inadequate, and in addition there grew up the concept of social service, administered by individuals trained in social work. When society as a whole accepted

responsibility for the welfare and security of its members, and greater understanding of human behaviour and social problems was achieved, social work became accepted as an integral part of community life.

The modern concept of social work was pioneered by the voluntary agency, supported by public-spirited citizens. A substantial amount of social service is still being provided in this way. One function of the voluntary agency was to press for government recognition of the need for welfare services and for the provision of public funds to support a broader program of public welfare. Government expenditures in the fields of health, welfare and social security are now larger than expenditures for any other peacetime purpose and rank second only to expenditures for national defence. Present estimates place the annual expenditure at about $2 billion for all governments — federal, provincial and municipal.

The greatly expanded program of public welfare and social security has increased the demand for well trained workers in this field. There is a current shortage of professionally trained social workers and the indications are that the supply will be inadequate for some years to come.

SOCIAL WORK IN CANADA

In Canada, social welfare is administered under public and voluntary auspices.

Public Welfare Services are provided through programs administered by the various municipal and provincial health and welfare departments, and federal departments such as National Health and Welfare, Veterans Affairs, Northern Affairs and Natural Resources, and Citizenship and Immigration, including the Indian Affairs Branch. Examples of programs provided under social security and welfare legislation are: family allowances, old age security, old age assistance, services to war veterans, mothers' allowances, public assistance to the needy, rehabilitation of the handicapped, services in mental health clinics and in correctional institutions.

Private Agency Services are usually more closely associated with the individual and his problems. In many cases they work closely with public welfare services through referrals when individuals are eligible for such assistance.

Private or voluntary agencies work with the physically or mentally handicapped, adult offenders, alcoholics, juvenile delinquents and others who present special social problems. They strive to strengthen family life and to prevent problems from arising both among children and adults. Very often the private agency identifies special problems and develops programs of proven worth that are later taken over by a public agency.

Voluntary agencies may be purely local, such as children's aid societies or family agencies, or they may be national or international in scope, such as the Canadian Council for Crippled Children and Adults and the Canadian Red Cross Society. Many of them operate with funds obtained through campaigns of community chests, federations or united appeals.

FIELDS OF WORK

The graduate of a school of social work has the prospect of employment in any of a wide variety of fields, including Family Welfare, Child Welfare, Public Assistance, Probation and Parole, Medical and Psychiatric Social Work, and Community Organization.

Family Welfare

Many voluntary agencies provide skilled social services to preserve the unity, stability and happiness of families threatened by marital discord, child-parent conflict, personality problems, cultural differences, problems of old age, physical or mental handicap, and household or financial management. These agencies often work in close contact with hospitals, child guidance clinics, child welfare agencies, churches, schools and public assistance authorities.

Child Welfare

This field is similar to that of family welfare, but focuses on the special needs of children. Child welfare is concerned with the care and protection of children who are abandoned, neglected, delinquent, physically handicapped or mentally defective, and for children whose physical and moral welfare is endangered by conditions in the home or the community. Both private and public agencies work in this field, although increasing responsibility is being placed with the public agency.

Child welfare has a strong appeal, for it is with children that preventive work can be most effective.

Medical Social Work

Increasing recognition by the medical profession of the importance of the social and psychological factors in the treatment of injury and disease has opened up a new field for social workers. The social worker, as a member of the medical team, works with patients and their families in order to help solve the social and emotional problems that prevent or delay recovery.

In addition to the usual social work skills, the social worker must have an understanding of the psychology of illness and a good background of medical information.

Photo : N.F.B.

. . . to help the handicapped to help themselves.

Psychiatric Social Work

The role of the social worker in the mental health field is particularly important, because the problems of the mentally disturbed may be related to social maladjustment. In this case the social worker is a member of the mental health team, which includes the psychiatrist and psychologist.

In a psychiatric hospital, for example, the social worker investigates the social and personal background of the patient, furnishes necessary social data to the psychiatrist, interprets the implications of mental illness to the patient's family and helps to prepare the patient and his family for the eventual homecoming. The social worker also maintains a follow-up of the case during the period of adjustment following discharge.

The extension of psychiatric and mental health services is creating a wide field of opportunity for those especially interested in psychiatric social work. All social workers, however, perform an important role in the promotion of good mental health; their basic training equips them for this wherever they work — in family, child welfare or other agencies.

Public Assistance and Social Security

The field of public assistance and social security includes all the services providing financial assistance to the aged, the blind, the permanently disabled, the widowed, and the unemployed. Public responsibility for the welfare of these groups rests with the various levels of government — municipal, provincial and federal. Such services involve the proper distribution of public funds voted for the purpose by legislation.

Social workers are needed by the public agencies providing these services to investigate eligibility, determine the extent of need and, when necessary, to assist the recipients in the proper use of funds. The social worker can, in many cases, render invaluable aid by recognizing other problems relating to economic hardship and by mobilizing other community services to help the individual become, to a greater degree, self-sufficient.

Probation and Parole Work

There has been, for some time, a growing interest in the social rehabilitation of the adult and juvenile offender. The emphasis is changing from punishment to correction.

Social workers are being used more and more in the role of probation counsellors and parole officers. Their work is to study the social background of offenders, evaluate the facts in each case, and make recommendations with regard to probation and parole. They also maintain contact with the probationer or parolee, often using the facilities of other public and private agencies in helping him become re-established.

The activity of the voluntary John Howard Societies and Elizabeth Fry Societies, working in co-operation with penitentiaries, has done much to create public interest and sympathy for the problems of the discharged offender, and to provide help in rehabilitation.

Other Fields

There is opportunity for a limited number of experienced, well qualified workers in teaching positions at university schools of social work.

Many social workers are finding scope for work as leaders in recreation departments of schools, community centres, parks and playgrounds. Local and national organizations such as the Boy Scouts, Girl Guides, YMCA, YWCA, church groups, trade unions, service clubs, youth hostels and similar groups also need the services of social workers.

In the industrial field, personnel work offers opportunity for those trained in social work. This field includes the activities of vocational rehabilitation carried on by some Workmen's Compensation Boards, the Special Placements Division and other departments of the National Employment Service, and industrial welfare carried on by private industry and organized labour.

NATURE OF THE WORK

Social work has developed a number of techniques or methods of work that are used to carry out its objectives. Casework, group work, community organization, administration and research are the main areas of activity, but are not separate specialties in themselves. They are integral parts of social work and all may be included in the day-to-day operations of a social service agency. The emphasis on one or another will vary with the type of service provided by the agency, its size, and the role of the individual worker.

Casework

Casework is the method used by social workers to help individuals to solve the problems that confront them. The problem may be one of marital difficulties, economic need, homelessness, neglect of children, juvenile delinquency, social aspects of illness, or other similar need for help.

The *caseworker* establishes personal contact with the client in order to obtain background information and to assess his needs and resources. By a process of counselling he assists the client to gain a better understanding of his problem and to develop ways of coping with it. A complete solution to the problem may require referral to other sources of help. He keeps case records and maintains follow-up until the case is closed.

Casework is the cornerstone of social service, and is the most highly developed of the social work techniques.

Group Work

Group work is a method of working with individuals as members of a group. There is a natural instinct in people of all ages to come together in common interest groups for study, recreation or fellowship. This same instinct, if misdirected, may lead to the formation of gangs of hoodlums and vandals. Some people who would like to belong to a group are afraid to do so because of shyness, racial or religious differences, or other reasons.

The *group worker* acts as leader, guiding the activity of the group in a way that will contribute to the personal growth of each individual. He encourages individuals to work and play together, to accept responsibility for activities and develop a sense of "belonging" to the community. Through the medium of group work, he helps individuals adjust to each other and to the group as a whole.

Group work is carried on among young and old, in hospitals, community centres, church organizations, and similar organizations fostering good citizenship and healthy recreation.

Community Organization

Social welfare must be planned in accordance with community needs and wishes. This requires a thorough knowledge of the prevailing structure of community organization for social welfare, including a vision of what social services might accomplish and a

realistic approach to what can be successfully undertaken in the immediate future.

The *community organizer* is concerned with developing resources to meet social needs and with securing the co-operation of all the social agencies for the welfare of the community. He is required to speak at public meetings, prepare reports based on research, present recommendations to municipal councils or other government bodies, and participate in the promotion of publicity or money-raising campaigns.

Examples of community organization operations are Welfare Councils and Community Chests.

Administration

The effective organization and operation of welfare programs requires skilful management by *welfare administrators.* The importance of the role of social welfare administration in Canada is emphasized by the size and scope of welfare and social security programs which serve the whole population. Although only a few of the most experienced and capable may expect to reach top administrative positions in the large agencies, there are extensive opportunities for those with administrative talent in the many small agencies.

Research

Growing recognition of the need for systematic inquiry into the nature and prevalence of social welfare problems, and methods of dealing with them effectively, has led to increased emphasis on research. Social research is conducted chiefly by specialists in a few large voluntary agencies, in the schools of social work, and in a number of government departments. It is also carried on as a part of administration in many agencies that do not have a special research staff.

QUALIFICATIONS

In few occupations are the personal factors more important than they are in social work.

Most important, perhaps, is a deep and sincere interest in people and the desire to help them. This attitude must be extended to people of all ages, races and religions. It requires patience, sympathy and a personal conviction of the worth of every human being.

Photo : N.F.B.

Emotional maturity is essential

Helping people to adjust to difficult and sometimes tragic problems calls for a high order of intelligence, resourcefulness and good judgment. At the same time a sense of humour is needed in order to maintain one's own perspective.

Such characteristics may only be expected in a well adjusted and emotionally mature person. It is for this reason that few students under the age of 21 are accepted by schools of social work. One *learns* to be a social worker, however, and in the learning process, personality development takes place.

The young student thinking of social work as a career cannot expect to have all these attributes at once — they are the result of having grown up. A great deal can be done in the meantime to develop them in day-to-day living. Participation in club work, sports, dramatics, public speaking and other activities, in addition to serious attention to school work, will help to develop leadership,

poise and a sense of responsibility. Volunteer, part-time or summer work in a social agency, camp or settlement is valuable in helping students determine whether they are suited for this type of work.

PREPARATION AND TRAINING

The usual preparation for social work is a university degree in the liberal arts, followed by one or two years of postgraduate study in a school of social work.

The student should plan his undergraduate preparation to provide a sound cultural background in the humanities with emphasis on the social sciences. Courses in psychology, sociology, economics and political science are desirable and in most cases are required for entry into a school of social work. In the first two years attention should be given to the broad range of cultural subjects — literature, languages, history and philosophy — in addition to introductory courses in the social sciences.

It is advisable for students wishing to enter social work to plan their undergraduate program with the advice of the school of social work where they intend to take their postgraduate training.

Postgraduate Education

The training in graduate schools includes study of the social background of the work and the particular techniques used in social work practice. Considerable emphasis is placed on practical experience in field work with carefully selected agencies that supply skilled supervision.

Classroom work includes lectures in the following areas: social casework, public welfare, research and statistics, social group work, medical information, psychiatric information, community organization and administration. A student wishing to specialize may, in senior schools, have his work in the second year oriented toward one of the major areas of social work, but the trend is more and more toward a general training that will fit students for work in any area.

Schools of Social Work

At present there are eight schools of social work in Canada, located as follows:

School of Social Work, University of British Columbia, Vancouver.

School of Social Work, University of Manitoba, Winnipeg.

School of Social Work, University of Toronto, Toronto.

School of Social Welfare, St. Patrick's College, University of Ottawa, Ottawa.

Section de Service Social, Université de Montréal, Montreal.

School of Social Work, McGill University, Montreal.

École de Service Social, Université Laval, Quebec City.

Maritime School of Social Work, c/o King's College, Halifax.

With a few exceptions for specially qualified persons, admission to these schools requires a B.A. degree, including courses in specified subjects. One year of postgraduate study leads to the Bachelor's degree in Social Work. The tendency, however, is to consider two years of postgraduate work, leading to a Master's degree in Social Work, a basic requirement for the fully trained worker. The calendars of the respective schools should be studied to determine the conditions under which degrees are granted. Admission is generally selective, and prospective students should communicate with university registrars well ahead of the commencement of the academic year. A personal interview may be necessary.

Student Assistance

A number of scholarships, bursaries and grants have been established by governments, interested organizations and individuals to help promising students. Information about the types of assistance available is outlined in the school calendars. Many agencies assist graduate students to finance their postgraduate studies on condition that they spend a specific number of years working with the agency after graduation.

In-Service Training

Social agencies also employ other workers in welfare positions who do not have professional qualifications. A number of these agencies have developed courses of in-service training for this group. The agencies are interested in securing people of some maturity and work experience, preferably with a Bachelor's degree or some university education. Many of these people are encouraged, after a year or two of experience, to enter a school of social work for professional education, sometimes assisted by the agency.

Photo : N.F.B.

Classes are usually small and informal.

ENTRY INTO THE PROFESSION

Since schools of social work are the main source of trained social workers, agencies seeking staff make their requirements known at these centres. Some students find that their field work leads to employment with the field work training agency.

The professional organization maintains a placement service, and social welfare journals carry advertisements of staff openings. Other openings may be found through application to the National Employment Service. The employment columns of newspapers often announce job opportunities. Positions for social workers in the federal government are posted in universities and public buildings.

EARNINGS

Improvements in salaries for social workers in recent years have placed them within the same range as a number of other salaried

professions. There is, however, considerable variation across the country. In the federal government service the range for qualified graduates is at present from $3,600 to $6,180, according to experience and responsibilities. Other federal positions for which social work training and experience is preferred, such as some administrative and research positions, carry higher salaries. Directors of large voluntary agencies or public departments may receive salaries in the $7,000 to $10,000 range, with a few positions above this level.

ADVANCEMENT

In the many small agencies in Canada, where workers carry out a combination of duties, advancement may be in the form of increased salary as work experience and responsibility increases. In larger agencies advancement to supervisory, administrative, or research work is the rule for those who have the capacity and inclination for such work. The rapid expansion of welfare work and the shortage of trained personnel have made advancement more rapid than in more established professions.

RELATED OCCUPATIONS

Training and experience in social work is a valuable background for occupations such as teaching, public relations or personnel work. It is also excellent preparation for marriage, parenthood and, indeed, all human relations.

ADVANTAGES AND DISADVANTAGES

Social workers are offered a variety of employment opportunities and, because of the wide recognition of their qualifications, are free to accept employment in all parts of Canada. International organizations offer posts in foreign countries for those who have sufficient qualification.

There is security of employment in this field because of the shortage of qualified workers and the continuing problems which require the services of social workers. Women may continue to work after marriage, if they wish to, either on a part-time or full-time basis. A recent survey revealed that 20 per cent of the women employed were married.

Salaries in social work have improved rapidly in the last few years, although they are not yet considered adequate recognition of the time and cost involved in professional training.

Employment in certain agencies may involve irregular hours, especially in the group work field. Many voluntary agencies have not yet been able to establish personnel policies and security provisions comparable to the best in industry and government.

Social workers, with a firm belief in the dignity and worth of the individual, find satisfaction in making a very real contribution to society.

ORGANIZATIONS

The Canadian Association of Social Workers, 18 Rideau Street, Ottawa, is a national association with branches in all parts of Canada. It seeks to promote the professional development of its members, to raise standards of practice and to ensure adequate service to the community. Membership in the C.A.S.W. is open to those with at least one year of professional training. It also has a student membership for students enrolled at a school of social work on a full-time basis. The professional journal of the Association is *The Social Worker—Le Travailleur Social* (bilingual).

The Canadian Welfare Council, 55 Parkdale Avenue, Ottawa, is a national association of welfare organizations and individual citizens, concerned with the overall study, planning and co-ordination of welfare services in Canada. It provides a consulting service for member organizations, carries out research and makes recommendations for social welfare legislation. Its principal publications are *Canadian Welfare* and *Bien-Être social canadien.*

The Canadian Conference on Social Work, 55 Parkdale Avenue, Ottawa, is an organization established for the purpose of holding biennial conferences to provide a national forum for the discussion of policy and practice in social welfare. Proceedings of the Conference are published.

TRENDS

Number in Occupation

Social work is a relatively young and rapidly growing profession. The 1951 Census of Canada listed 3,995 persons as social workers. It must be kept in mind, however, that a fair percentage of this number were not professionally qualified. Membership in the Canadian Association of Social Workers at the beginning of 1957 was approximately 2,000.

Photo : N.F.B.

Top level planning for social welfare.

This occupation has always attracted more women than men; in 1951 the ratio was about 5 to 3. However, increasing numbers of men are entering the occupation as a result of greater opportunities that now exist in social work.

A decrease in the average age of all workers reflects the influx of new, young workers into the field in recent years. Between 1941 and 1951 the percentage of workers aged 55 and over dropped from 25 to 20 for men, from 16 to 13 for women, and from 18 to 16 for all workers. The average (median) age for all workers in 1951 was 37 years.

Geographical Distribution

The need for social workers is greatest in crowded industrial areas, although there is a significant demand for workers in rural and outlying areas, particularly by provincial welfare departments and child welfare agencies. The degree to which this need is being met depends to some extent on the willingness and ability of public and private agencies to supply the necessary funds and also on the availability of qualified workers.

Growth

There has been a marked growth in the numbers of workers engaged in this field. According to the 1931 census there were 1,173 social workers. By 1941 the number had increased to 1,805, an increase of 54 per cent. By 1951 the number had reached nearly 4,000 — a further increase of more than 121 per cent in ten years.

This growth can be attributed to the increased awareness of public responsibility for social welfare, increased urbanization, and a buoyant economy that has made available the funds necessary to provide social services.

Present Demand and Supply

There is an acute shortage of social workers in Canada. The increase in social security legislation, the greater recognition of the need for trained workers, and the continual pressure to improve welfare standards, have all added to the demand. Another factor is the considerable turnover caused by the withdrawal of young women from the profession on their marriage.

A nation-wide survey of over 4,200 welfare positions in public and private agencies, conducted by the Department of National

Health and Welfare in 1951, revealed that about one-half of all welfare positions were filled by personnel without professional training. However, the survey also indicated that employers wanted graduates of schools of social work to fill 86 per cent of the vacancies in 1951. They expressed a long-term preference for graduates in three-quarters of all welfare positions.

The shortage of professional social workers for 1952 was estimated at over 400 and for 1956 at about 1,000. The services in all provinces are feeling this shortage, both in urban and rural areas.

The number of trained workers graduating from schools of social work each year is estimated to be about 350 at the present time.

Outlook

There will be ample opportunity for an increasing number of graduates in this profession for an indefinite number of years. There is also the probability that a considerable but diminishing number of non-professional social workers will continue to be employed. Advancement will be increasingly limited for those who do not take professional courses. For those who do become professionally qualified, the field is a wide one with improving opportunities and remuneration.

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LOCAL INFORMATION

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"CANADIAN OCCUPATIONS" SERIES

Monographs and Pamphlets

The monographs listed below, accompanied by pamphlets, except in the case of numbers 12, 13 and 39, have been published to date.

(1) Carpenter
(2) Bricklayers and Stone-Masons
(3) Plasterer
(4) Painter
(5) Plumber, Pipe Fitter and Steam Fitter
(6) Sheet-Metal Worker
(7) Electrician
(8) Machinist and Machine Operators (Metal)
(9) Printing Trades
(10) Motor Vehicle Mechanic
(11) Optometrist
(12) Social Worker
(13) Lawyer
(14) Mining Occupations
(15) Foundry Workers
(16) Technical Occupations in Radio and Electronics
(17) Forge Shop Occupations
(18) Tool and Die Makers
(19) Railway Careers

Careers in Natural Science and Engineering: (20-35, one booklet)

(20) Agricultural Scientist
(21) Architect
(22) Biologist
(23) Chemist
(24) Geologist
(25) Physicist
(26) Aeronautical Engineer
(27) —
(28) Chemical Engineer
(29) Civil Engineer
(30) Electrical Engineer
(31) Forest Engineer and Forest Scientist
(32) Mechanical Engineer
(33) Metallurgical Engineer
(34) Mining Engineer
(35) Petroleum Engineer

(36) Hospital Workers (Other than Professional)
(37) Draughtsman
(38) Welder
(39) Careers in Home Economics
(40) Occupations in the Aircraft Manufacturing Industry
(41) Careers in Construction

Filmstrips

The Department of Labour has prepared, to date, the following occupational filmstrips in collaboration with the National Film Board. A manual has been prepared as an accompaniment to each filmstrip. These may be purchased from the National Film Board, Box 6100, Montreal, or from any one of its regional offices.

Plumber, Pipefitter and Steamfitter
Careers in the Engineering Profession
The Social Worker
Technical Occupations in Radio and Electronics
Bricklayer and Stone-Mason
Printing Trades
Careers in Natural Science
Careers in Home Economics
Motor Vehicle Mechanic
Mining Occupations
Draughtsman
Careers in Construction

DEPARTMENT OF LABOUR

Economics and Research Branch

CANADA 1957

OTTAWA
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(41) Careers in Construction
(42) Medical Laboratory Technologist
(43) Careers in Meteorology
(44) Teacher
(45) Physical and Occupational Therapist.

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HON. MICHAEL STARR, MINISTER
A. H. BROWN, DEPUTY MINISTER

DEPARTMENT OF LABOUR, CANADA

PRINTED IN CANADA

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FOREWORD

During recent years there has been a steadily increasing demand for up-to-date information on occupations.

This demand comes from youth faced with the need of choosing an occupation and of selecting the type of training required; from parents, teachers and other counsellors; from workers shifting to other occupations; from employment service officers; from directors of personnel and union officials, and from other quarters.

This series of monographs and an accompanying series of pamphlets, the latter containing similar information in a condensed form, are attempts to meet this demand. These publications are designed for general use and cover a wide range of occupations, including professions. They indicate, among other things, the nature of the occupation or group of occupations, entrance and training requirements, working conditions and opportunities in each.

The staff of the Occupational Analysis Section has prepared this series with the generous assistance of representatives of management, trade unions, and professional associations. The cooperation of the Unemployment Insurance Commission, the Vocational Training Branch of the Department of Labour, and the Dominion Bureau of Statistics is gratefully acknowledged.

Acknowledgment is also made of the assistance obtained from numerous publications on occupations prepared in Canada and in other countries.

DIRECTOR,
Economics and Research Branch,
Department of Labour.

October 1959.

CONTENTS

	page
HISTORY AND IMPORTANCE	4
SOCIAL WELFARE IN CANADA	5
FIELDS OF WORK	6
Family Welfare	6
Child Welfare	6
Medical Social Work	7
Psychiatric Social Work	8
Public Assistance and Social Security	8
Probation and Parole Work	8
Other Fields	9
NATURE OF THE WORK	9
Casework	10
Group Work	10
Community Organization	10
Administration	11
Research	11
QUALIFICATIONS	11
PREPARATION AND TRAINING	13
Postgraduate Education	13
Schools of Social Work	13
Student Assistance	14
In-Service Training	14
ENTRY INTO THE PROFESSION	15
EARNINGS	15
ADVANCEMENT	16
RELATED OCCUPATIONS	16
ADVANTAGES AND DISADVANTAGES	16
ORGANIZATIONS	17
TRENDS	17
Number in Occupation	17
Geographical Distribution	19
Growth	19
Present Demand and Supply	19
Outlook	20
REFERENCES	20

SOCIAL WORKER

Photo : N.F.B.

Social service is carried out by trained workers.

HISTORY AND IMPORTANCE

Social work as a profession is relatively young, although its principles and practice have been carried on for centuries by religious and philanthropic groups or individuals interested in human welfare and happiness.

Years ago, when hardship and tragedy struck, friends and relatives would very often come to help in a spirit of neighborliness. As society became more complex and impersonal, such informal charity and help became inadequate, and in addition there grew up the concept of social service, administered by individuals trained in social work. When society as a whole accepted

responsibility for the welfare and security of its members, and greater understanding of human behaviour and social problems was achieved, social work became accepted as an integral part of community life.

The modern concept of social work was pioneered by the voluntary agency, supported by public-spirited citizens. A substantial amount of social service is still being provided in this way. One function of the voluntary agency was to press for government recognition of the need for welfare services and for the provision of public funds to support a broader program of public welfare. Government expenditures in the fields of health, welfare and social security are now larger than expenditures for any other peacetime purpose and rank second only to expenditures for national defence. Present estimates place the annual expenditure at about $2 billion for all governments — federal, provincial and municipal.

The greatly expanded program of public welfare and social security has increased the demand for well trained workers in this field. There is a current shortage of professionally trained social workers and the indications are that the supply will be inadequate for some years to come.

SOCIAL WELFARE IN CANADA

In Canada, social welfare is administered under public and voluntary auspices.

Public Welfare Services are provided through programs administered by the various municipal and provincial health and welfare departments, and federal departments such as National Health and Welfare, Veterans Affairs, Northern Affairs and Natural Resources, and Citizenship and Immigration, including the Indian Affairs Branch. Examples of programs provided under social security and welfare legislation are: family allowances, old age security, old age assistance, services to war veterans, mothers' allowances, public assistance to the needy, rehabilitation of the handicapped, services in mental health clinics and in correctional institutions.

Private Agency Services are usually more closely associated with the individual and his problems. In many cases they work closely with public welfare services through referrals when individuals are eligible for such assistance.

Private or voluntary agencies work with the physically or mentally handicapped, adult offenders, alcoholics, juvenile delinquents and others who present special social problems. They strive to strengthen family life and to prevent problems from arising both among children and adults. Very often the private agency identifies special problems and develops programs of proven worth that are later taken over by a public agency.

Voluntary agencies may be purely local, such as children's aid societies or family agencies, or they may be national or international in scope, such as the Canadian Council for Crippled Children and Adults and the Canadian Red Cross Society. Many of them operate with funds obtained through campaigns of community chests, federations or united appeals.

FIELDS OF WORK

The graduate of a school of social work has the prospect of employment in any of a wide variety of fields, including Family Welfare, Child Welfare, Public Assistance, Probation and Parole, Medical and Psychiatric Social Work, and Community Organization.

Family Welfare

Many voluntary agencies provide skilled social services to preserve the unity, stability and happiness of families threatened by marital discord, child-parent conflict, personality problems, cultural differences, problems of old age, physical or mental handicap, and household or financial management. These agencies often work in close contact with hospitals, child guidance clinics, child welfare agencies, churches, schools and public assistance authorities.

Child Welfare

This field is similar to that of family welfare, but focuses on the special needs of children. Child welfare is concerned with the care and protection of children who are abandoned, neglected, delinquent, physically handicapped or mentally defective, and for children whose physical and moral welfare is endangered by conditions in the home or the community. Both private and public agencies work in this field, although increasing responsibility is being placed with the public agency.

Child welfare has a strong appeal, for it is with children that preventive work can be most effective.

Medical Social Work

Increasing recognition by the medical profession of the importance of the social and psychological factors in the treatment of injury and disease has opened up a new field for social workers. The social worker, as a member of the medical team, works with patients and their families in order to help solve the social and emotional problems that prevent or delay recovery.

In addition to the usual social work skills, the social worker must have an understanding of the psychology of illness and a good background of medical information.

Photo : N.F.B.

. . . to help the handicapped to help themselves.

Psychiatric Social Work

The role of the social worker in the mental health field is particularly important, because the problems of the mentally disturbed may be related to social maladjustment. In this case the social worker is a member of the mental health team, which includes the psychiatrist and psychologist.

In a psychiatric hospital, for example, the social worker investigates the social and personal background of the patient, furnishes necessary social data to the psychiatrist, interprets the implications of mental illness to the patient's family and helps to prepare the patient and his family for the eventual homecoming. The social worker also maintains a follow-up of the case during the period of adjustment following discharge.

The extension of psychiatric and mental health services is creating a wide field of opportunity for those especially interested in psychiatric social work. All social workers, however, perform an important role in the promotion of good mental health; their basic training equips them for this wherever they work — in family, child welfare or other agencies.

Public Assistance and Social Security

The field of public assistance and social security includes all the services providing financial assistance to the aged, the blind, the permanently disabled, the widowed, and the unemployed. Public responsibility for the welfare of these groups rests with the various levels of government — municipal, provincial and federal. Such services involve the proper distribution of public funds voted for the purpose by legislation.

Social workers are needed by the public agencies providing these services to investigate eligibility, determine the extent of need and, when necessary, to assist the recipients in the proper use of funds. The social worker can, in many cases, render invaluable aid by recognizing other problems relating to economic hardship and by mobilizing other community services to help the individual become, to a greater degree, self-sufficient.

Probation and Parole Work

There has been, for some time, a growing interest in the social rehabilitation of the adult and juvenile offender. The emphasis is changing from punishment to correction.

Social workers are being used more and more in the role of probation counsellors and parole officers. Their work is to study the social background of offenders, evaluate the facts in each case, and make recommendations with regard to probation and parole. They also maintain contact with the probationer or parolee, often using the facilities of other public and private agencies in helping him become re-established.

The activity of the voluntary John Howard Societies and Elizabeth Fry Societies, working in co-operation with penitentiaries, has done much to create public interest and sympathy for the problems of the discharged offender, and to provide help in rehabilitation.

Other Fields

There is opportunity for a limited number of experienced, well qualified workers in teaching positions at university schools of social work.

Many social workers are finding scope for work as leaders in recreation departments of schools, community centres, parks and playgrounds. Local and national organizations such as the Boy Scouts, Girl Guides, YMCA, YWCA, church groups, trade unions, service clubs, youth hostels and similar groups also need the services of social workers.

In the industrial field, personnel work offers opportunity for those trained in social work. This field includes the activities of vocational rehabilitation carried on by some Workmen's Compensation Boards, the Special Placements Division and other departments of the National Employment Service, and industrial welfare carried on by private industry and organized labour.

NATURE OF THE WORK

Social work has developed a number of techniques or methods of work that are used to carry out its objectives. Casework, group work, community organization, administration and research are the main areas of activity, but are not separate specialties in themselves. They are integral parts of social work and all may be included in the day-to-day operations of a social service agency. The emphasis on one or another will vary with the type of service provided by the agency, its size, and the role of the individual worker.

Casework

Casework is the method used by social workers to help individuals to solve the problems that confront them. The problem may be one of marital difficulties, economic need, homelessness, neglect of children, juvenile delinquency, social aspects of illness, or other similar need for help.

The *caseworker* establishes personal contact with the client in order to obtain background information and to assess his needs and resources. By a process of counselling he assists the client to gain a better understanding of his problem and to develop ways of coping with it. A complete solution to the problem may require referral to other sources of help. He keeps case records and maintains follow-up until the case is closed.

Casework is the cornerstone of social service, and is the most highly developed of the social work techniques.

Group Work

Group work is a method of working with individuals as members of a group. There is a natural instinct in people of all ages to come together in common interest groups for study, recreation or fellowship. This same instinct, if misdirected, may lead to the formation of gangs of hoodlums and vandals. Some people who would like to belong to a group are afraid to do so because of shyness, racial or religious differences, or other reasons.

The *group worker* acts as leader, guiding the activity of the group in a way that will contribute to the personal growth of each individual. He encourages individuals to work and play together, to accept responsibility for activities and develop a sense of "belonging" to the community. Through the medium of group work, he helps individuals adjust to each other and to the group as a whole.

Group work is carried on among young and old, in hospitals, community centres, church organizations, and similar organizations fostering good citizenship and healthy recreation.

Community Organization

Social welfare must be planned in accordance with community needs and wishes. This requires a thorough knowledge of the prevailing structure of community organization for social welfare, including a vision of what social services might accomplish and a

realistic approach to what can be successfully undertaken in the immediate future.

The *community organizer* is concerned with developing resources to meet social needs and with securing the co-operation of all the social agencies for the welfare of the community. He is required to speak at public meetings, prepare reports based on research, present recommendations to municipal councils or other government bodies, and participate in the promotion of publicity or money-raising campaigns.

Examples of community organization operations are Welfare Councils and Community Chests.

Administration

The effective organization and operation of welfare programs requires skilful management by *welfare administrators*. The importance of the role of social welfare administration in Canada is emphasized by the size and scope of welfare and social security programs which serve the whole population. Although only a few of the most experienced and capable may expect to reach top administrative positions in the large agencies, there are extensive opportunities for those with administrative talent in the many small agencies.

Research

Growing recognition of the need for systematic inquiry into the nature and prevalence of social welfare problems, and methods of dealing with them effectively, has led to increased emphasis on research. Social research is conducted chiefly by specialists in a few large voluntary agencies, in the schools of social work, and in a number of government departments. It is also carried on as a part of administration in many agencies that do not have a special research staff.

QUALIFICATIONS

In few occupations are the personal factors more important than they are in social work.

Most important, perhaps, is a deep and sincere interest in people and the desire to help them. This attitude must be extended to people of all ages, races and religions. It requires patience, sympathy and a personal conviction of the worth of every human being.

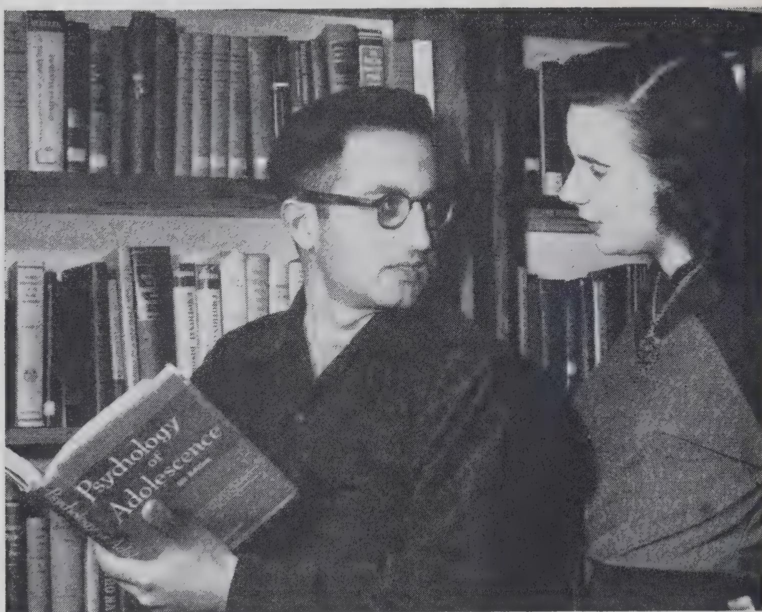

Photo : N.F.B.

Emotional maturity is essential

Helping people to adjust to difficult and sometimes tragic problems calls for a high order of intelligence, resourcefulness and good judgment. At the same time a sense of humour is needed in order to maintain one's own perspective.

Such characteristics may only be expected in a well adjusted and emotionally mature person. It is for this reason that few students under the age of 21 are accepted by schools of social work. One *learns* to be a social worker, however, and in the learning process, personality development takes place.

The young student thinking of social work as a career cannot expect to have all these attributes at once — they are the result of having grown up. A great deal can be done in the meantime to develop them in day-to-day living. Participation in club work, sports, dramatics, public speaking and other activities, in addition to serious attention to school work, will help to develop leadership,

poise and a sense of responsibility. Volunteer, part-time or summer work in a social agency, camp or settlement is valuable in helping students determine whether they are suited for this type of work.

PREPARATION AND TRAINING

The usual preparation for social work is a university degree in the liberal arts, followed by one or two years of postgraduate study in a school of social work.

The student should plan his undergraduate preparation to provide a sound cultural background in the humanities with emphasis on the social sciences. Courses in psychology, sociology, economics and political science are desirable and in most cases are required for entry into a school of social work. In the first two years attention should be given to the broad range of cultural subjects — literature, languages, history and philosophy — in addition to introductory courses in the social sciences.

It is advisable for students wishing to enter social work to plan their undergraduate program with the advice of the school of social work where they intend to take their postgraduate training.

Postgraduate Education

The training in graduate schools includes study of the social background of the work and the particular techniques used in social work practice. Considerable emphasis is placed on practical experience in field work with carefully selected agencies that supply skilled supervision.

Classroom work includes lectures in the following areas: social casework, public welfare, research and statistics, social group work, medical information, psychiatric information, community organization and administration. A student wishing to specialize may, in senior schools, have his work in the second year oriented toward one of the major areas of social work, but the trend is more and more toward a general training that will fit students for work in any area.

Schools of Social Work

At present there are eight schools of social work in Canada, located as follows:

School of Social Work, University of British Columbia, Vancouver.

School of Social Work, University of Manitoba, Winnipeg.

School of Social Work, University of Toronto, Toronto.

School of Social Welfare, St. Patrick's College, University of Ottawa, Ottawa.

École de Service Social, Université de Montréal, Montreal.

School of Social Work, McGill University, Montreal.

École de Service Social, Université Laval, Quebec City.

Maritime School of Social Work, 150 Coburg Street, Halifax.

With a few exceptions for specially qualified persons, admission to these schools requires a B.A. degree, including courses in specified subjects. One year of postgraduate study leads to the Bachelor's degree in Social Work. The tendency, however, is to consider two years of postgraduate work, leading to a Master's degree in Social Work, a basic requirement for the fully trained worker. The calendars of the respective schools should be studied to determine the conditions under which degrees are granted. Admission is generally selective, and prospective students should communicate with university registrars well ahead of the commencement of the academic year. A personal interview may be necessary.

Student Assistance

A number of scholarships, bursaries and grants have been established by governments, interested organizations and individuals to help promising students. Information about the types of assistance available is outlined in the school calendars. Many agencies assist graduate students to finance their postgraduate studies on condition that they spend a specific number of years working with the agency after graduation.

In-Service Training

Social agencies also employ other workers in welfare positions who do not have professional qualifications. A number of these agencies have developed courses of in-service training for this group. The agencies are interested in securing people of some maturity and work experience, preferably with a Bachelor's degree or some university education. Many of these people are encouraged, after a year or two of experience, to enter a school of social work for professional education, sometimes assisted by the agency.

Photo : N.F.B.

Classes are usually small and informal.

ENTRY INTO THE PROFESSION

Since schools of social work are the main source of trained social workers, agencies seeking staff make their requirements known at these centres. Some students find that their field work leads to employment with the field work training agency.

The professional organization maintains a placement service, and social welfare journals carry advertisements of staff openings. Other openings may be found through application to the National Employment Service. The employment columns of newspapers often announce job opportunities. Positions for social workers in the federal government are posted in universities and public buildings.

EARNINGS

Improvements in salaries for social workers in recent years have placed them within the same range as a number of other salaried

professions. There is, however, considerable variation across the country. In the federal government service the range for qualified graduates is at present from $3,600 to $6,180, according to experience and responsibilities. Other federal positions for which social work training and experience is preferred, such as some administrative and research positions, carry higher salaries. Directors of large voluntary agencies or public departments may receive salaries in the $7,000 to $10,000 range, with a few positions above this level.

ADVANCEMENT

In the many small agencies in Canada, where workers carry out a combination of duties, advancement may be in the form of increased salary as work experience and responsibility increases. In larger agencies advancement to supervisory, administrative, or research work is the rule for those who have the capacity and inclination for such work. The rapid expansion of welfare work and the shortage of trained personnel have made advancement more rapid than in more established professions.

RELATED OCCUPATIONS

Training and experience in social work is a valuable background for occupations such as teaching, public relations or personnel work. It is also excellent preparation for marriage, parenthood and, indeed, all human relations.

ADVANTAGES AND DISADVANTAGES

Social workers are offered a variety of employment opportunities and, because of the wide recognition of their qualifications, are free to accept employment in all parts of Canada. International organizations offer posts in foreign countries for those who have sufficient qualification.

There is security of employment in this field because of the shortage of qualified workers and the continuing problems which require the services of social workers. Women may continue to work after marriage, if they wish to, either on a part-time or full-time basis. A recent survey revealed that 20 per cent of the women employed were married.

Salaries in social work have improved rapidly in the last few years, although they are not yet considered adequate recognition of the time and cost involved in professional training.

Employment in certain agencies may involve irregular hours, especially in the group work field. Many voluntary agencies have not yet been able to establish personnel policies and security provisions comparable to the best in industry and government.

Social workers, with a firm belief in the dignity and worth of the individual, find satisfaction in making a very real contribution to society.

ORGANIZATIONS

The Canadian Association of Social Workers, 18 Rideau Street, Ottawa, is a national association with branches in all parts of Canada. It seeks to promote the professional development of its members, to raise standards of practice and to ensure adequate service to the community. Membership in the C.A.S.W. is open to those with at least one year of professional training. It also has a student membership for students enrolled at a school of social work on a full-time basis. The professional journal of the Association is *The Social Worker—Le Travailleur Social* (bilingual).

The Canadian Welfare Council, 55 Parkdale Avenue, Ottawa, is a national association of welfare organizations and individual citizens, concerned with the overall study, planning and co-ordination of welfare services in Canada. It provides a consulting service for member organizations, carries out research and makes recommendations for social welfare legislation. Its principal publications are *Canadian Welfare* and *Bien-Être social canadien*.

The Canadian Conference on Social Work, 55 Parkdale Avenue, Ottawa, is an organization established for the purpose of holding biennial conferences to provide a national forum for the discussion of policy and practice in social welfare. Proceedings of the Conference are published.

TRENDS

Number in Occupation

Social work is a relatively young and rapidly growing profession. The 1951 Census of Canada listed 3,995 persons as social workers. It must be kept in mind, however, that a fair percentage of this number were not professionally qualified. Membership in the Canadian Association of Social Workers at the beginning of 1959 was approximately 2,200.

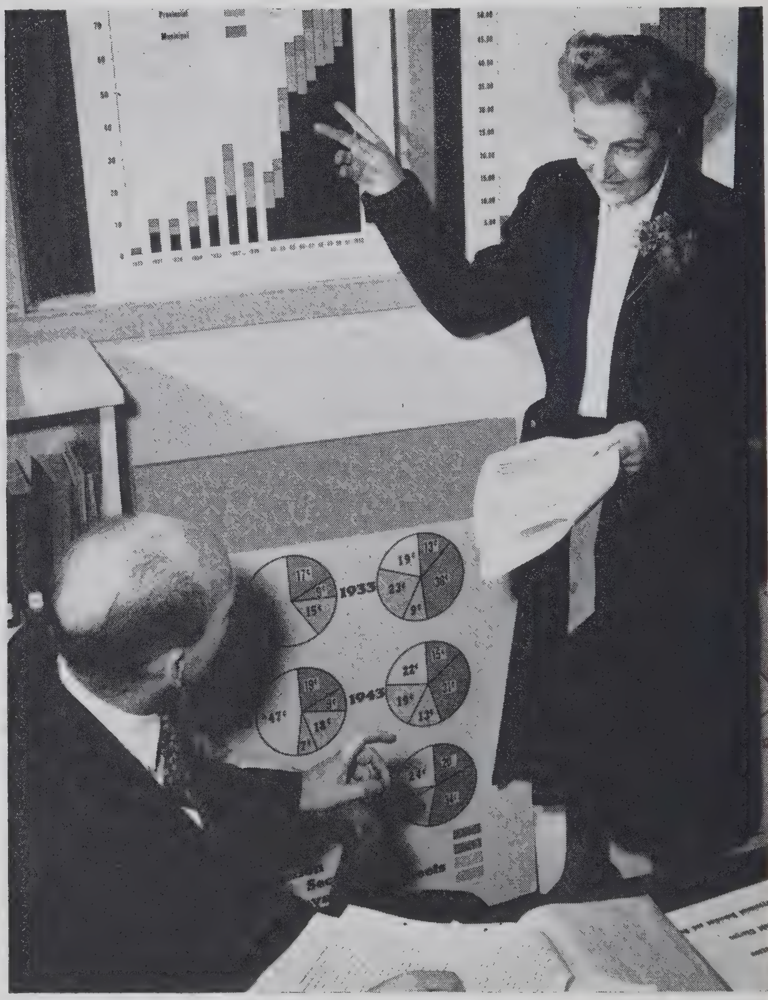

Photo : N.F.B.

Top level planning for social welfare.

This occupation has always attracted more women than men; in 1951 the ratio was about 5 to 3. However, increasing numbers of men are entering the occupation as a result of greater opportunities that now exist in social work.

A decrease in the average age of all workers reflects the influx of new, young workers into the field in recent years. Between 1941 and 1951 the percentage of workers aged 55 and over dropped from 25 to 20 for men, from 16 to 13 for women, and from 18 to 16 for all workers. The average (median) age for all workers in 1951 was 37 years.

Geographical Distribution

The need for social workers is greatest in crowded industrial areas, although there is a significant demand for workers in rural and outlying areas, particularly by provincial welfare departments and child welfare agencies. The degree to which this need is being met depends to some extent on the willingness and ability of public and private agencies to supply the necessary funds and also on the availability of qualified workers.

Growth

There has been a marked growth in the numbers of workers engaged in this field. According to the 1931 census there were 1,173 social workers. By 1941 the number had increased to 1,805, an increase of 54 per cent. By 1951 the number had reached nearly 4,000 — a further increase of more than 121 per cent in ten years.

This growth can be attributed to the increased awareness of public responsibility for social welfare, increased urbanization, and a buoyant economy that has made available the funds necessary to provide social services.

Present Demand and Supply

There is an acute shortage of social workers in Canada. The increase in social security legislation, the greater recognition of the need for trained workers, and the continual pressure to improve welfare standards, have all added to the demand. Another factor is the considerable turnover caused by the withdrawal of young women from the profession on their marriage.

A nation-wide survey of over 4,200 welfare positions in public and private agencies, conducted by the Department of National

Health and Welfare in 1951, revealed that about one-half of all welfare positions were filled by personnel without professional training. However, the survey also indicated that employers wanted graduates of schools of social work to fill 86 per cent of the vacancies in 1951. They expressed a long-term preference for graduates in three-quarters of all welfare positions.

The shortage of professional social workers for 1956 was estimated at about 1,000. The services in all provinces are feeling this shortage, both in urban and rural areas.

The number of trained workers graduating from schools of social work each year is estimated to be about 250 at the present time.

Outlook

There will be ample opportunity for an increasing number of graduates in this profession for an indefinite number of years. There is also the probability that a considerable but diminishing number of non-professional social workers will continue to be employed. Advancement will be increasingly limited for those who do not take professional courses. For those who do become professionally qualified, the field is a wide one with improving opportunities and remuneration.

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LOCAL INFORMATION

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CANADIAN OCCUPATIONS FILMSTRIPS

The Department of Labour has prepared, to date, the following occupational filmstrips in collaboration with the National Film Board. A manual has been prepared as an accompaniment to each filmstrip. These may be purchased from the National Film Board, Box 6100, Montreal, or from any one of its regional offices.

Plumber, Pipefitter and Steamfitter
Careers in the Engineering Profession
The Social Worker
Technical Occupations in Radio and Electronics
Bricklayer and Stone-Mason
Printing Trades
Careers in Natural Science
Careers in Home Economics
Motor Vehicle Mechanic
Mining Occupations
Draughtsman
Careers in Construction
Sheet Metal Workers
Machine Shop Occupations
Careers in Meteorology
Medical Laboratory Technologist (in colour)
Teacher (in colour)

DEPARTMENT OF LABOUR

Economics and Research Branch

CANADA, 1959

Price 10 cents Cat. No. L 43-1259
Available from the Queen's Printer
Ottawa, Canada

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CANADIAN OCCUPATIONS

★

LAWYER

★

MONOGRAPH 13

DEPARTMENT OF LABOUR, OTTAWA

CANADIAN OCCUPATIONS

★

LAWYER

MONOGRAPH 13

HON. MILTON F. GREGG, V.C., MINISTER
ARTHUR MACNAMARA, C.M.G., LL.D., DEPUTY MINISTER

DEPARTMENT OF LABOUR, OTTAWA

FOREWORD

During recent years there has been a steadily increasing demand for up-to-date information on occupations.

This demand comes from youth faced with the need of choosing an occupation and of selecting the type of training required; from parents, teachers and other counsellors; from workers shifting to other occupations; from employment service officers; from directors of personnel and union officials, and from other quarters.

This series of monographs and an accompanying series of pamphlets, the latter containing similar information in a condensed form, are attempts to meet this demand. No pamphlet is being issued in this case.

These publications represent an expansion of an earlier series issued by the Department of Veterans Affairs to assist members of the armed forces returning to civilian life following the end of the war. These current series, designed for general use, cover a wide range of occupations, including professions. They indicate, among other things, the nature of the occupations or group of occupations, entrance and training requirements, working conditions and opportunities in each.

The monographs have been prepared by our research staff working on occupations, with the generous help and advice of officials of the Unemployment Insurance Commission, Vocational Training Branch of the Department of Labour, Dominion Bureau of Statistics, Provincial Departments of Education and of Labour, employers' associations, trade unions, professional associations, and other government and non-government bodies.

Grateful acknowledgment is made of this assistance and that obtained from numerous publications on occupations prepared in Canada and in other countries.

DIRECTOR,
Economics and Research Branch,
Department of Labour.

March, 1951.

LAWYER

HISTORY AND IMPORTANCE

From the earliest dawn of civilization, there has been necessary a set of rules regulating the conduct of individuals towards one another and towards the state or ruler. As personal property and real property became features of community life, new rules, often in the interest of social or economic groups, were set up. It has always been easier to add to legislation than to remove it, and, though some autocratic rulers in ancient times codified the general principles of their laws, and in more modern times such documents as Magna Carta and the Bill of Rights laid down definite principles, there has been no end of the making of laws, and they very early got beyond the comprehension and knowledge of all citizens other than a special class whose life work was their interpretation and administration.

The life of Canadians is regulated by laws made by three authorities, the Dominion government, the provincial government, and the municipality. To these might be added, in certain circumstances, the bodies responsible for international law. If one leaves Canada, the regulations for admission to the country visited, and its general and local laws, must be complied with.

The lawyer is the specialist who advises the citizen, conducts his business in the courts, or in matters requiring legal supervision, such as real property sales, or decides disputes in which the law applies, whether between individuals or in connection with the relation of the individual's conduct towards the community or state.

FIELD OF THE LEGAL PROFESSION

Since laws good, bad, indifferent, ancient or modern cover almost the entire range of human activity, there must inevitably be some division of these into groups, for practical purposes.

International Law, Admiralty Law, Military Law, Medical Jurisprudence, Company Law, Real Property Law, Criminal Law, Canon Law, Divorce Law, Chancery Law, Constitutional Law, and the laws regarding Domestic Relations, Partnership, Trusteeship, Contracts, Banking, Wills, Torts, and Inheritance are some of these groups.

Specialization in one or more of these is possible in the larger cities; law resembles medicine and surgery in that it has its general practitioners who refer cases to specialists when necessary.

There are three main functional groups of lawyers:

(a) Barristers (b) Solicitors

(c) Judges and Magistrates

In Canada the first two may, except in the case of Quebec, be combined; in Britain they are always separate, only barristers having the right of audience in the higher courts.

Practice may be general or specialized, as above indicated, in the case of lawyers on their own account. Many, however, are employed on a salary basis by legal firms, by large companies or by Dominion, provincial or municipal authorities. Government employment may be in a judicial, advisory, administrative or executive capacity. Judges, while appointed and paid by the government, are not "employed" in the sense that they can be dismissed. They hold office during "good behaviour".

Lawyers have always formed a very great proportion of our legislators in Canada, the multiplicity of governments and their inter-relation favouring this choice of candidates by party organizations.

They have been found very useful in the diplomatic service, also. In Canada, as well as in the United States, another nation with multiple governments, the legal profession wields more power and has more opportunity for public distinction and political influence than in most other countries.

DUTIES

The *general* definition of "lawyer" given in the United States Dictionary of Occupational Titles is: "A classification title for persons of recognized education, experience, and legal qualifications who are engaged in such phases of law as conducting criminal or civil law-suits, drawing up legal documents, or searching property titles." To this should be added "advise clients and represent them in court and in their transactions with lawyers representing others."

Admiralty lawyers specialize in law as applied to ships and shipping.

Civil lawyers deal with damage suits, contracts, leases, wills, trusteeships, etc.

Corporation lawyers act as agents for companies and incorporated bodies in various transactions, and as legal advisers.

Criminal lawyers deal with offences against society.

Tort lawyers specialize in suits for wrong, injury or damage to individuals, excluding breaches of contract.

Patent, Real Estate and other specialized lawyers perform duties indicated by their titles.

Judges preside as arbitrators, advisers and administrators in a court of law. They rule on the admissibility of evidence, and in criminal cases where guilt is established they sentence the guilty party.

In the service of governments, lawyers occupy advisory and administrative posts in which a knowledge of law and of legal procedure is required.

RELATED OCCUPATIONS

Lay magistrates and justices of the peace perform duties related to those of the judicial branch.

Police officers, sheriffs, and bailiffs have duties complementary to those of lawyers, and are required to know some phases of law.

QUALIFICATIONS

The educational minimum for legal training is Senior Matriculation, followed by at least two years in Arts, in most provinces; in some provinces a separate examination is set.

Personal qualities necessary are an ability to study, to develop critical analysis and to reduce a problem to broad principles, a good command of language, perseverance, a capacity for meeting and dealing with people of all kinds, high ethical standards, and a systematic and businesslike habit of thought.

TRAINING

The organization of this profession being on a provincial basis, the regulations of each province must be studied. The general requirement is a period of practical training on the job as an articled clerk to an established lawyer, accompanied, preceded, or followed by a course of from two to three years at the provincial law school. The following is a brief summary of the requirements in the various provinces:

Prince Edward Island: Articles: Students with B.A. or B.Sc. degree, 4 years; those holding no degree, 5 years; the latter must pass a preliminary examination. Those with a degree of LL.B. from a recognized school need serve only 18 months.

School: Most students attend Dalhousie, a few Osgoode Hall. Any law school recognized by the Council of the Law Society may be attended. Articled students may qualify for admission as attorney or barrister by passing the Society's examinations without attending law school.

Nova Scotia: Articles: With Arts, Science or Commerce degree, 3 years; with B.C.L. or LL.B. degree, 9 months; Matriculants, 4 years.

School: Dalhousie University, 3 years. There is provision for passing three professional examinations at intervals of one year in lieu of a uni-

AMENDMENTS

P.7 TRAINING - Ontario

The 1951-52 "Law Students' Handbook" of the Law Society of Upper Canada gives new regulations as follows:

Graduates: 4 years - 1st and 2nd year, full time Law School (Osgoode Hall); 3rd year, full time Articled service; 4th year, concurrent Law School and Articled service.
Matriculants: 6 years - 1st and 2nd year, full time Articled service; 3rd and 4th year, full time Law School; 5th year, full time Articled service; 6th year, concurrent Law School and Articled service.
Holders of LL.B., University of Toronto: 1 year Articled service; 1 year concurrent Articled service and Law School. Must pass examinations prescribed for last 2 years of Law Society course.

Articles may be assigned, transferring from one solicitor to another.

TRAINING - Newfoundland

3 years' articles; studies directed by Law Society of Newfoundland; examination by Law Society. Most students take training in this way. Others study at Dalhousie; a few at Osgoode Hall or McGill: one or two at Oxford (Rhodes Scholars).

versity course; these examinations are based on that course.

New Brunswick: *Articles:* with degree (Arts or Law), 3 years; with two years' Arts or grammar school licence of N.B. Board of Education, 4 years.

School: Faculty of Law, University of New Brunswick, 3 years, preceded by 2 years' Arts. Degree B.C.L.

Quebec: *Articles:* Recent legislation has abolished indentures as a law student. The last year of the university course, now extended to 4 years, is for procedure work at the university, directed by the Bar of the Province of Quebec.

Schools: Universities of McGill, Montreal, and Laval Law Faculties, 4 years. (Women were excluded until 1941 from the practice of law in Quebec, but 5 Geo. 6, Ch. 56 amended the interpretation of the Bar Act so as to admit them).

Ontario: *Articles:* 3 years, concurrent with law school in the case of approved graduates in Arts, Science, Commerce and Engineering, and R.M.C. graduates. 2 years following 3-year law school, for Senior Matriculants or students with 1 year Arts at approved universities, or 1st year at R.M.C.

School: Osgoode Hall, operated by Law Society of Upper Canada, 3 years. (The University of Toronto has a 3 years' course for Bachelor of Laws, and a combined 5 years' B.A. and B.L. course. The Law Society does not accept these other than as on a par with Arts, R.M.C. and similar degree courses.)

Manitoba: *Articles:* With B.A. standing, 4 years; with 2nd year Arts, 5 years; may be concurrent or partially concurrent with law school course.

School: Faculty of Law, University of Manitoba, 4 years, degree LL.B.

Saskatchewan: *Articles:* Served following graduation from an approved law school or completion of three years at such school. For graduates in Arts and Science of a recognized university who have this requirement, articles are served for one year, two years for students who have completed second year Arts or Science. Before enrolment as a barrister or solicitor, graduate students-at-law must have been on the books of the Law Society for three years and non-graduates for five years.

School: University of Saskatchewan Law School, Saskatoon, 3 years for Matriculants. Degree LL.B. Students must also complete one course in accounting at the University of Saskatchewan. The Law Society accepts other Canadian Law degrees, if approved.

Alberta: *Articles:* 1 year, following graduation from law school. An examination is given at end of articles before admission to the Bar.

School: Faculty of Law, University of Alberta, 3 years for those holding degrees (Arts, etc.). A combined 5-year B.A., LL.B. course is given for those with Senior Matriculation only. The B.A. is given at the end of the penultimate year. Two specified history courses must be taken in addition to the regular law courses for the 3 years' Law degree. (Special provisions for admission of law students and practitioners of British Empire countries is made by the Law Society. British subjects qualified as legal practitioners in other countries may be admitted to articles under certain conditions.)

British Columbia: *Articles:* Graduates in Arts or Law of Canadian or United Kingdom universities, R.M.C. graduates, Commerce graduates of McGill or the University of B.C., or bona fide law clerks with 10 years' service with a member of the Law Society, serve 3 years. All others serve 5 years, except that special provision is made for students-at-law of other provinces.

School: Faculty of Law, University of British Columbia, 3 years. Degree LL.B. Pre-

requisite, 2 years' Arts, or equivalent. A combined course, 3 years' Arts, 3 years' Law, leads to Arts degree (granted in penultimate year of Law course) as well as LL.B. Students-at-law in Vancouver must attend a proportion of lectures. Others may attend. All must pass annual examinations.

(There are special provisions for the admission of legal practitioners from other provinces and countries.)

The above is an outline only. Those contemplating a legal career should obtain the printed rules of the Law Society or Bar Association of the province concerned, and ascertain the application of the many clauses to their particular cases. Since the prospective lawyer will need to be articled to a legal practitioner, he will be able to verify the interpretation of the clauses when making tentative arrangements for articles.

ENTERING THE PROFESSION

The requirements of the various associations and societies governing admission to practice in the respective provinces are generally indicated above. In most cases an examination, the payment of specified fees, and in all cases evidence of completion of term of articled service, and of academic qualifications, are required.

Actually, when a student is articled, he is considered to belong to the profession.

ADVANCEMENT

Most newly admitted barristers and solicitors enter the employment of an established legal firm, where they remain to gain knowledge and experience until admitted to a partnership, or until setting up their own offices. Some may, after several years as an employee in a law office, obtain a consulting, executive or administrative position in government, municipal, industrial, or financial employment. Those practising on their own account may, by specializing in certain types of court work, attain eminence and corresponding prosperity. Others may be

appointed to judicial posts. Some may combine practice with membership of Parliament or of a Legislative Assembly, having usually a partner. Many have attained Cabinet rank, and the profession has been well represented among Prime Ministers and Provincial Premiers.

EARNINGS

Students are often paid a nominal salary, from $35 to $75 a month. Some, however, receive no remuneration.

Since a great proportion of lawyers work on their own account, no comprehensive data on incomes are available, but it is known that the variation in individual earnings is very great. The Dominion Bureau of Statistics publication, "Supply and Demand in the Professions" (1945), gives the following information:

In 1931, 435 male magistrates and judges averaged $5,644. Four women averaged $2,100.

In 1941, 477 male magistrates and judges averaged $5,369.

1,000 male lawyers and notaries averaged $3,236 in 1931, and 1,276 averaged $2,833 in 1941.

17 female lawyers and notaries averaged $1,941 in 1931, and $1,510 in 1941.

These figures, in the case of judges and magistrates, can be regarded as a coverage of the entire group; for the rest of the profession they represent a sampling of little more than one-eighth of the total.

A report released in 1950 by the Dominion Bureau of Statistics on a survey conducted with the assistance of the Canadian Bar Association covers the earnings in 1946, 1947 and 1948 of approximately 7,200 full-time and 500 part-time lawyers.

Average earnings of all full-time lawyers were $5,031 in 1946 and $5,843 in 1948. In the latter year partners in law firms earned an average of $8,943; salaried lawyers in government service, $6,758; salaried lawyers

in law firms, $2,934. Salaried lawyers in government include judges and other court officials; and the majority of this group have considerable professional experience. Most salaried lawyers in law firms are young men. The age group with the highest earnings was that in the "50's", which averaged $7,800. In private practice the peak earning period was that between 20 and 29 years of practice; salaried lawyers obtained their maximum income after forty years of professional work.

As far as location is concerned, the most profitable places of practice were cities between 100,000 and 500,000 population.

ADVANTAGES AND DISADVANTAGES

No profession holds out greater rewards of an economic and political nature for the ambitious man. Its social standing is high, its professional regulation protects its members from lowered status, and conserves its high ethical standards. Some types of practice, perhaps not the most remunerative, will provide inward satisfaction. Nevertheless, the profession as a whole is a powerful bulwark for the defence of our liberties.

Against these advantages must be offset the cost of training, the problem of obtaining a clientele, and the very onerous responsibilities which must be accepted.

TRENDS

Number in Profession

The 1941 Census recorded 480 judges and magistrates, and 8,621 lawyers and notaries. Of these, 3 judges and 701 others were on active service.

This number is about two-thirds of that of physicians and surgeons, and twice that of college professors. On a population basis, Canada in 1921 had 850 lawyers per

million inhabitants, Great Britain 474, and the United States 1,159. By 1941, there were approximately 750 lawyers per million population in Canada.

Age Distribution

This profession, in the decades 1921-31 and 1931-41, had a trend towards a reduction in the average age, except in the case of those in the judiciary, of whom 386 out of 477 were over 55, and 206 over 65, in 1941, maintaining the almost 80 per cent proportion in the over-55 group found in 1921.

In other branches, however, only 22 per cent were in the over-55 years group in 1941, as compared with 27 per cent in 1921. (The average for all occupations is under 18 per cent.)

Sex Distribution

Women are very few in this profession. In 1941 they numbered 129 only, or about 1.5 per cent.

Geographical Distribution

Since law is necessary in the conduct of all types of business and government activities, there is no marked difference in regional distribution of the legal profession. Where there are courts there are likely to be more lawyers, but courts are widely distributed, usually in large towns and cities. Certain legal specialists will, of course, practise in the larger cities, where higher courts are located.

The distribution by provinces in 1941 bears a reasonably close relation to that of population. Ontario with approximately 34 per cent of total population had 35 per cent of all lawyers; Quebec with 29 per cent of the population had 32 per cent; the Prairie Region with 21 per cent of population had 18 per cent; the figures for the Maritimes are 8.5 per cent and 7.7 per cent; for British Columbia, 7.5 per cent and 7.3 per cent. Economic conditions in the Maritimes and the Prairie Region in the 1930's may have had some effect on the number of practitioners, but the

variation is slight. The judiciary branch was proportionately almost twice as large in Ontario as in Quebec, and in the Maritimes as in British Columbia or Alberta.

Urban centres of 30,000 and over have from 2 to 4 times the proportion of lawyers that there is in small centres.

Functional Distribution

Approximately 5 per cent of all lawyers occupied judicial posts in 1941. Of the remainder, 97.3 per cent were listed under professional service. Finance and insurance engaged 1.2 per cent, the remaining 1.5 per cent were in manufacturing, construction, transportation, trade and commerce. The 701 on active service were not included in these percentages, but they are unlikely to vary them much. There is no record of the number specializing in various aspects of the profession, other than the judiciary.

Growth

This profession has not kept pace in numbers with the growth of the population. In 1921 it numbered 7,484, in a population of 8,800,000, or one in 1,175; in 1931 there were 8,548 to a population of 10,400,000; in 1941 lawyers totalled 9,111 in a population of 11,500,000, or one in 1,260.

Unemployment

The provincial basis of this profession, limiting to a great extent movement to other regions, will always cause local financial conditions to affect its activities and income. The less firmly established members will feel the fluctuations most.

Present Demand and Supply

The Weir report of 1943 made an estimate of 315 as the current need, but, in view of the fact that at least 700 lawyers were on active service then, this seems inconclusive.

If the profession was capable of absorbing 200 annually, and was, as shown in the Dominion Bureau of Statistics' publication, "Supply and Demand in the Professions in Canada" (1945), receiving only 100 annually in the last three war years, then a shortage of 300 new graduates existed in 1946, and was probably increased by at least 100 then, making 400 in all.

There were 269 graduates in 1947, and 438 in 1948. Although the actual figure for 1949 is not available, there were probably about 525 graduates in that year. Expected graduation in 1950 may be estimated, from available data, as 750.

With the growth of population and business and industrial activity since the pre-war period, it seems reasonable to conclude that an annual demand for as many as 300 new entrants into the profession has existed in the post-war period. On this basis, a theoretical projection of demand and supply might be made as follows:

	Demand	Graduates	Deficiency
1947	300		
plus accumulated	400		
	700	269	431
1948	300		
plus accumulated	431		
	731	438	293
1949	300		
plus accumulated	293		
	593	525	68
1950	300		
plus accumulated	68		
	368	750	382 (Excess)

The large number of graduates for the years 1948, 1949 and 1950 was due to the considerable veteran enrolment. Since this group will be negligible from now on, it may be expected that in 1951 and onwards there will be appreciably smaller graduating classes. As indicated above, it would appear that the supply of graduates is more than enough to meet demand. However, the smaller graduating classes that can be expected henceforth may help to bring about a better balance between demand and supply. Much depends on economic developments. Some of the factors which may affect the profession are given below.

Qualifying Factors

The activities of the legal profession are greater in times of prosperity. New enterprises, new contracts, sales and leases of property, expansion of businesses, all require legal services. Litigation in both business and personal relationships is increased, too.

All laws increasing taxation or imposing restrictions on any phase of economic or social activity make for more professional business.

Problems arising out of wartime or trade conditions, or the constitutional relations between governments, provide highly remunerative employment on Royal Commissions for senior members of the profession.

Changes in standards of conduct, the general disturbance of settled habits caused by the war, the effects of the pre-war depression on individuals, as well as the increasing use of motor vehicles, have all contributed to the amount of legal business resulting from crimes and misdemeanours, and to a greatly increased volume of divorce cases. Social security legislation, on the contrary, tends to reduce some types of practice.

The judiciary branch is little affected by changing conditions, being harder worked, however, as cases multiply. Its members increase only with the creation of new courts, usually in newly-settled areas, which are now few.

Conclusion

Success in law depends, while in the student stage, on adequate finances, on ability to study and remember, and on the opportunities for practical work provided in the employer's practice.

The lawyer newly admitted will have to rely on his own personality, ability, energy and perseverance, as well as on local economic and social conditions, for his success.

This profession has potentialities of great rewards for the aggressive, ambitious and capable man.

ORGANIZATIONS

The Canadian Bar Association is the central organization of the whole profession. It is not a licensing or governing body, membership being voluntary.

The autonomous provincial licensing bodies are:

The Law Society of Prince Edward Island, Charlottetown.

The Nova Scotia Barristers' Society, Law Courts, Halifax.

The Barristers' Society of New Brunswick, Fredericton. (The Saint John, N.B., Law Society is a local professional organization).

The Bar of the Province of Quebec, 159 Craig St. West, Montreal (Sections in Montreal, Quebec, Hull, Three Rivers, Lower St. Lawrence, Richelieu, St. Francis, Arthabaska, Laurentides, Bedford and Saguenay) (The Bar of Montreal, Court House, Montreal, is a local society. The Board of Notaries of the Province of Quebec is another internal organization).

The Law Society of Upper Canada, Osgoode Hall, Toronto (The County of York Law Association is a local society).

The Law Society of Manitoba, Law Courts, Winnipeg.

The Law Society of Saskatchewan, Court House, Regina.

The Law Society of Alberta, McLeod Bldg., Edmonton.

The Law Society of British Columbia, Victoria, B.C.

REFERENCES

London Free Press, brochure — *Law Opens Wide Field of Service.*

R.C.A.F. Occupational Review — *Lawyers.*

The Rules and Regulations of the Provincial law societies listed above.

The Legal Professions Acts of the provinces.

The *Canadian Bar Review.*

APPENDIX

Fees for enrolment as Student-at-law, for examinations, and for admission as Barrister, Attorney or Solicitor, vary in the provinces.

The following table totals such fees as last ascertained. (Admission of students or lawyers from other provinces and Empire countries is subject to special fees, usually reciprocal, and in some cases very high).

Alberta	**$290**	**Nova Scotia**	**$496**
British Columbia	**$250**	**Ontario**	**$262**
Manitoba	**$302**	**P.E.I.**	**$240**
New Brunswick	**$160**	**Quebec**	**$382**
		Saskatchewan	**$150**

These fees do not cover, of course, cost of tuition, and in the cases of British Columbia, Manitoba, Ontario, Quebec and Saskatchewan the figures given do not include examination fees. Since changes may take place, they should be verified with the Law Society or Bar Association to which entry is desired. They are given here as a rough guide only, since misapprehensions exist as to their size. For details the Regulations of the respective organizations should be studied.

LOCAL INFORMATION

LOCAL INFORMATION

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"CANADIAN OCCUPATIONS" SERIES

The monographs listed below, accompanied by pamphlets in the case of numbers 1 to 12, have been published to date. Those from 20-35 have been published collectively.

(1) *Carpenter*

(2) *Bricklayers and Stone Masons*

(3) *Plasterer*

(4) *Painter*

(5) *Plumber, Pipe Fitter and Steam Fitter*

(6) *Sheet-Metal Worker*

(7) *Electrician*

(8) *Machinist and Machine Operators (Metal)*

(9) *Printing Trades*

(10) *Motor Vehicle Mechanic and Repairman*

(11) *Optometrist*

(12) *Social Worker*

(13) *Lawyer*

Careers in Natural Science and Engineering: (20-35)

(20) "Agricultural Scientist"

(21) "Architect"

(22) "Biologist"

(23) "Chemist"

(24) "Geologist"

(25) "Physicist"

(26) "Aeronautical Engineer"

(27) "Ceramic Engineer"

(28) "Chemical Engineer"

(29) "Civil Engineer"

(30) "Electrical Engineer"

(31) "Forest Engineer and Forest Scientists"

(32) "Mechanical Engineer"

(33) "Metallurgical Engineer"

(34) "Mining Engineer"

(35) "Petroleum Engineer"

DEPARTMENT OF LABOUR

Economics and Research Branch

OTTAWA, 1951

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LAWYER

MONOGRAPH 13

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DEPARTMENT OF LABOUR, CANADA

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CANADIAN OCCUPATIONS

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LAWYER

MONOGRAPH 13

REVISED 1958

HON. MICHAEL STARR, MINISTER

A. H. BROWN, DEPUTY MINISTER

DEPARTMENT OF LABOUR, CANADA

PRICE: 10 CENTS

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FOREWORD

During recent years there has been a steadily increasing demand for Canadian occupational information. This demand comes from youth faced with the need of choosing an occupation and preparing for it; from parents, teachers and vocational guidance counsellors; from workers wishing to change their occupations; from employment service officers; from personnel directors and union officials; and from other quarters.

The "Canadian Occupations" series of monographs is designed to help meet this demand. Each booklet describes, among other things, the nature of the occupation or group of occupations, entrance and training requirements, working conditions and employment outlook.

Occupational information tends to become dated as a result of changes in economic conditions, industrial technology, wage and salary structure, etc. Revision of outdated publications is a regular feature of this series, and space is left in the last few pages of each monograph for recent changes and other local information concerning the occupation.

This series has been prepared with the generous assistance of representatives of management, trade unions and professional associations. The co-operation of the Unemployment Insurance Commission, the Vocational Training Branch of the Department of Labour, and the Dominion Bureau of Statistics is gratefully acknowledged.

The revised edition of this monograph was written by H. Stuart Fisher under the direction of William Allison, Chief of the Occupational Analysis Section. Grateful acknowledgement is extended to The Canadian Bar Association and the various provincial law societies for their co-operation in checking the textual material.

DIRECTOR,
Economics and Research Branch,
Department of Labour.

August 1958.

LAWYER

HISTORY AND IMPORTANCE

The lawyer is a specialist who makes a study of laws and their application to human affairs. Laws have been in existence, in one form or another, since the beginning of civilization. When men first banded together for survival, they must have sensed the need for a set of rules governing their conduct toward each other. Even primitive tribes existing today have unwritten rules and taboos that guide their daily lives.

Originally, laws were made and enforced by the tribal chiefs, with the help of their advisors. With the growth of civilization, living together became more complicated, and the rights and duties of individuals became the concern of all. Also, as personal and real property became features of community life, new rules, often in the interest of social or economic groups, were set up. In ancient times some autocratic rulers codified the general unwritten principles of their laws. More recently, such documents as Magna Carta and the Bill of Rights laid down definite principles of law. Today, in most democratic countries, laws are passed only after authoritative groups, representing all segments of a community or nation, have reached an agreement of the majority.

The day-to-day living of Canadians is controlled by the rules and regulations laid down by three levels of law-making authority—the federal government, the provincial governments, and the municipalities. To these might be added, in certain circumstances, the bodies responsible for international law. In addition, on leaving Canada, one must conform to regulations governing aliens in another country.

As it has always been easier to add to legislation than to remove it, there has been no end to the making of laws. Very early in history the number and complexity of laws got beyond the comprehension and knowledge of all citizens other than a special class who spent their lives interpreting and administering these laws. The lawyer therefore belongs to a professional group which derives its origin from the roots of the past.

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FIELD OF THE LEGAL PROFESSION

Since laws cover almost the full range of human activities, they must, for all practical purposes, be divided into groups. Some of these groups are: Admiralty Law, International Law, Company Law, Real Property Law, Criminal Law, Constitutional Law, and the laws regarding Domestic Relations, Partnership, Banking, Wills, Torts, and Inheritance.

Lawyers, especially those located in the larger cities, tend to specialize in one or more fields of law. Some lawyers, however, like the general practitioners in the medical profession, handle many different types of legal problems, referring them when necessary to the specialist.

Lawyers function either as *barristers* or *solicitors*. Barristers present cases before courts of law; solicitors give advice on legal matters, prepare cases for presentation in court and conduct other legal business not requiring litigation. In contrast to Great Britain, where the two roles are quite separate, lawyers in Canada may perform both functions. There is, however, a second legal profession in the Province of Quebec, that of the *notary*. The notary is required to have the same qualifications and follow the same course of studies as a member of the Bar of the Province of Quebec. In many ways, such as not being permitted to plead a case before the courts, notaries resemble the solicitors under the British system.

Judges and *magistrates* could be considered as another functional group of lawyers. Although judges are invariably appointed from the ranks of lawyers, training in the legal profession is not an essential prerequisite to one's appointment as a magistrate (an exception to this is in the province of New Brunswick, where appointments to the magistracy must be made from members of the Bar having at least three years standing). It should be noted too, that although judges are paid by the government they are not subject to government control, nor may they be arbitrarily dismissed, but hold office during "good behavior".

Many lawyers build up a private practice, of a general or specialized nature, working either on their own account or as partners in a law firm. Others work for law firms on a salary basis. Large companies employ lawyers in their legal departments, as do the various departments of the federal, provincial and municipal governments. Government employment may be in an advisory, administrative or executive capacity. This may involve such matters as pleading in courts, or preparation of legislation, and drafting of legal documents.

Because of their legal training and experience, lawyers are often active in political groups. As a result, a very great proportion of the members of our legislative bodies are lawyers and persons with legal background. In point of fact, nine of our thirteen prime ministers have come from the ranks of the legal profession.

DUTIES

A general definition given in the United States *Dictionary of Occupational Titles* is as follows: "LAWYER (advocate; attorney; barrister; counselor; counselor-at-law; jurist; solicitor)—a classification title for persons of recognized education, experience and legal qualifications who are engaged in such phases of law as conducting criminal or civil lawsuits, drawing up legal documents, or searching property titles".

Most people are familiar with the more dramatic aspect of a lawyer's duties—that of presenting a case before a court of law. This is but one phase of the work, however, and gives little indication of the amount of investigation, study and planning that goes on behind the scenes. This preparatory work, done in many cases by the lawyer himself, is also quite often the assigned task of other lawyers who may never appear in court. Also, many lawyers are active in a type of law practice that does not entail courtroom work.

Lawyers who specialize in one or more specific fields of law may have certain duties peculiar to their specialty. *Corporation lawyers* act as agents and legal advisors for companies and incorporated bodies in various business transactions. *Criminal*

59580-1—2½

lawyers deal with offences against society, either prosecuting or defending the accused. *Civil lawyers* deal with damage suits, contracts, leases, wills, trusteeships, etc. *Tort lawyers* specialize in suits for wrong, injury or damage to individuals, excluding breaches of contract. *Admiralty, patent, real estate* and other specialized lawyers perform duties as indicated by their titles.

In the Province of Quebec, many different types of legal problems that do not require litigation (lawsuits) are handled by *notaries*. They search property titles, settle estates, incorporate companies, and act as financial agents and legal advisors in business transactions. They draw up and keep on record the originals of documents such as Deeds of Sale, Last Wills, Articles of Partnership, and many others.

Judges and *magistrates* decide questions of fact or law in the courts. They are responsible for maintaining the respect and dignity of the court; ruling on the admissibility of evidence; granting decrees; giving judgment in civil cases; deciding the guilt or innocence of an accused in criminal cases; and imposing sentences. If juries are used, the judge must also instruct the jury on its duties and functions as well as on the law.

QUALIFICATIONS

The personal qualities that characterize a young lawyer will, to a great extent, determine the degree of success he may expect and also the area of practice he is likely to choose.

Generally speaking, an individual must have a fairly high order of intelligence and the ability to work and study hard in order to achieve graduation from law school and later to carry out the duties of the profession. The trust and responsibility that rests with the legal profession demands that lawyers be persons of good moral character and integrity. As much of the work is concerned with the precise meaning and interpretation of words and phrases, a good command of written and spoken language is of great importance.

Tact, good business sense and judgment, and an understanding of human nature are all important personal qualities in legal work. Although lawyers are not required to perform heavy

physical labour, the nature of their work does impose considerable mental strain and frequently taxes their physical capacities. For this reason, good health is essential, but physical handicap need be no real bar to success.

PREPARATION AND TRAINING

Preparation for a career in law should begin early in high school. Here prospective lawyers have the opportunity to acquire and develop many of the attributes essential to future success. The daily associations in academic, athletic and social activities, provide them with a basic understanding of human nature that will later prove extremely valuable. Active participation in debating and public speaking is an excellent way in which to acquire confidence and poise when appearing before an audience. In preparing and delivering debates and speeches they are able to expand their powers of reasoning and expression. In addition, they become familiar with public argument and accustomed to accepting criticism.

Completion of 2 years of university work following senior matriculation or 3 years following junior matriculation is, in most provinces, an essential prerequisite to entering the study of law. In some cases, however, prospective law school students must hold a Bachelor's degree in Arts, Commerce or Science from a recognized university.

Training for a career in law is received either at one of the university law schools or at a provincial law school that may or may not be affiliated with a university. Courses usually require 3 to 5 years to complete and lead to the degree of Bachelor of Law (LL.B.) or Bachelor of Civil Law (B.C.L.). A number of schools offer combined courses that lead to a Bachelor's degree in Arts or Commerce in addition to the degree in Law. Graduates of some schools may, through completion of post-graduate courses, earn the degrees of Master of Law (LL.M.) and Doctor of Law (LL.D.).

Although the Course of Studies of one school may not correspond directly with that of another school, there is some degree of similarity. A brief description of some of the areas covered is given in the following:

In *Constitutional Law,* students study such matters as English and Canadian Constitutional Law including the various British North America Acts, and a vast amount of case law.

Wills and Administration includes the principles of the acts pertaining to wills and their probation; the drafting of wills, their execution, validity, interpretation and administration; how executors and administrators are appointed, their powers and duties.

Courses in *Criminal Law* cover a history and definition of the law, its principles and their application to individual cases as prescribed in the Criminal Code of Canada; questions of evidence; and problems of procedure.

Company Law is a study of the principles of business organization; the formation and powers of a company, under both Provincial and Dominion Acts; the dissolution of a company; and the liabilities of the company, the directors, and the shareholders.

Legal Accounting provides prospective lawyers with the principles of accounting that are of particular interest to their profession. It includes the maintenance of books for law offices and trust funds; the preparation of balance sheets; and taxation.

Other courses include: Property Law; Insurance, Banking, Bills and Notes; Laws of Evidence; Legal Research and Writing; International Law; Legal Ethics; Comparative Law; and Jurisprudence.

In addition to attending lectures and passing written and oral examinations, students at most law schools are required to write a thesis on an approved subject and submit it to their examining board. This is usually done in the final year. In some law schools, students may be required to argue a case before what is termed a "Moot Court". This is over and above the regular "Practice Courts" that are an integral part of the

"Procedure" course. In some provinces, law students assist in the operation of "Legal Aid Clinics" that are available to people who cannot afford to engage a lawyer.

Since this profession is organized on a provincial basis, the regulations of each province differ in some respects and must be considered individually. Included in the general requirements of all provinces is a period of practical training on the job as an *articled clerk* (student) to an established lawyer, accompanied, preceded or followed by a course at a law school recognized by the provincial law society. In most provinces, this period of training is reduced for those who have attained a higher level of education prior to entering articles.

The following is a brief summary of the provincial requirements by province:

Newfoundland

Articles: Students having previously completed senior matriculation or first year Memorial University, St. John's, serve 5 years. Those having completed second year Memorial University or the Intermediate Examinations in Arts, Science or Law at a recognized university, serve 4 years. Persons holding a recognized Bachelor's, Master's or Doctor's degree in Arts, Science or Law need serve only 3 years.

School: Any law school recognized by the Law Society of Newfoundland may be attended. The time spent may be credited, under certain conditions and in accordance with the Rules of the Law Society, toward the completion of the time required under Articles.

Prince Edward Island

Articles: Students with a B.A. or B.Sc. degree serve 4 years; those holding no degree serve 5 years. The latter must pass a preliminary examination equivalent to at least the second year of a university course. Those with an LL.B. degree from any recognized university need serve only 18 months. This period

may be reduced by students obtaining credit for time spent working in a law office during the summer holidays after the first and second years of law school training.

School: Any law school recognized by the Law Society may be attended. Articled clerks may qualify for admission as barristers without attending law school by following a course of studies laid down by the Law Society and by successfully writing three sets of professional examinations set by the examiners of the Law Society. A period of two years under articles must be served, however, before one is entitled to sit for the first set of examinations and at least one year must elapse between successive sets.

Nova Scotia

Articles: Students holding a B.A., B.Sc. or equivalent degree serve 3 years 9 months. Those with a B.C.L. or LL.B. degree serve only 9 months. All others must serve for a period of 5 years.

School: Dalhousie University, 3 years. Provision has been made for articled students to take three professional examinations at intervals of one year in lieu of a university course. These examinations are based on the university Law Course (Dalhousie).

New Brunswick

Articles: 3 years. Students-at-law having received a degree in law from the University of New Brunswick may be admitted as barristers or solicitors without further examination. Those having a degree from another university must pass the examinations set by the Law Society of New Bunswick.

School: University of New Brunswick, Faculty of Law, 3 years, degree B.C.L. To be admitted as students-at-law, applicants must have a degree in Arts or Science from a recognized university, or have completed 3 years of the Arts or Science course at a university that will grant them a degree in Arts or Science following completion of their first year in the Law Course.

Quebec

Articles: Recent legislation has abolished indenture as a law student. The last year of the 4-year Law Course is a course in practical training under the direction of a university in the Province of Quebec or the University of Ottawa.

School: To be admitted to the study of law, one must hold a recognized B.A. degree. The 4-year Law Course is available from the Faculties of Law at the Universities of McGill, Montreal, Laval, Ottawa or Sherbrooke.

Ontario

School: Under the new plan for legal training in Ontario, to be admitted to the study of law at an approved law school, students are required to hold a B.A. or equivalent degree, or to have completed 2 years of university work following senior matriculation or 3 years following junior matriculation. The *Law School Course,* a basic uniform course of 3 years' duration leading to a degree in Law, is now offered at the University of Ottawa, the University of Toronto, Queen's University (Kingston), and Osgoode Hall (Toronto). A number of other universities in Ontario have indicated their intention to establish Law Faculties in the near future.

Articles: Graduates of the Law Course who wish to be admitted to the Bar of Ontario are required to serve a 15-month period of articles to a lawyer anywhere in Ontario from June of their graduating year to the beginning of September of the following year.

Bar Admission Course: After completion of articles, applicants must then take a 6-month intensive course in practical training at Osgoode Hall.

Manitoba

Articles: There are two classes of students-at-law and/or articled clerks—the graduate class and the non-graduate class. The graduate class serves articles for 4 years, the non-graduate class, 5 years. The educational standards that must be met for admission to either class are set out in the rules of the Manitoba Law Society.

School: Manitoba Law School, affiliated with the University of Manitoba, 4 years, degree LL.B.

Saskatchewan

Articles: Served following graduation from an approved law school. Students having previously graduated in Arts, Science or Commerce, or from R.M.C., serve articles for 1 year. Those having completed only 2 years' Arts, Science, Commerce or R.M.C., must serve articles for 2 years. All are required to pass Bar examinations in Practice, and Dominion and Saskatchewan Statutes.

School: University of Saskatchewan Law School, Saskatoon, 3 years, degree LL.B. Students must also complete one course in Accounting at the university.

Alberta

Articles: 1 year, served following graduation from law school. An examination is given at the end of articles before admission to the Bar.

School: University of Alberta, Faculty of Law, 3 years, degree LL.B. Prerequisite is a Bachelor's degree or, alternatively, a combined 5-year B.A., LL.B. course is offered for those with senior matriculation. The B.A. degree is granted in the penultimate year of the course.

British Columbia

Articles: 1 year, served following graduation in law from a recognized university.

School: University of British Columbia, 3 years' Arts with certain minimum grades, then Faculty of Law, 3 years, degree LL.B. A combined course, consisting of one year Arts and 3 years' Commerce, 3 years' Law, leading to the degree B.Comm. (granted in the penultimate year of the Law Course) as well as the degree LL.B., is also available.

As the above is an outline only, persons contemplating a career in law should obtain a copy of the rules and regulations of the Law Society or Bar Association of the province in which they expect to practise.

ENTERING THE PROFESSION

Admission to the practice of law in any of the provinces in Canada is subject to the rules and regulations of the provincial law society concerned. Included in the requirements in most cases are an examination and the payment of specified fees, and in all cases, evidence of academic qualification and completion of the necessary term of articles. Actually, when a student is articled he is considered to be a member of the profession.

Lawyers usually begin their careers as employees of established law firms. Some, however, go directly into private practice on their own account; others go into the business world as legal advisors to private companies. A substantial number of lawyers may enter the legal profession as solicitors, advisory counsel, etc., in one of the many departments of the various government bodies in Canada.

Lawyers wishing to practise in another province must satisfy the transfer requirements of that province. Similarly, law students wishing recognition in one province for training received in another, may be required to satisfy certain regulations governing such transfer.

The National Employment Service of the Unemployment Insurance Commission maintains an Executive and Professional Section to assist members of the various professions in finding employment. Persons qualified as lawyers, and seeking employment, should register at the nearest National Employment office. NES offices are located in every city and most large towns across Canada.

Admission of Non-Canadians

The admission of law students or lawyers from other countries is governed by fairly specific regulations laid down by each provincial law society. Legal training received outside of the British Commonwealth is not ordinarily acceptable for admission and most provincial law societies require applicants to be British subjects.

ADVANCEMENT

There are several avenues of advancement open to those who begin their careers as employees of established law firms. Some, after having gained practical experience, may be accepted into the firm on a partnership basis; others may leave the firm to set up their own offices and go into private practice for themselves. Some lawyers, after a period of law practice, may then accept a position in an industrial or financial concern in an advisory, executive or administrative capacity.

Lawyers who enter private practice may, through ability and diligent effort, rise to a position of eminence and corresponding prosperity in either a general or a specialized type of practice. This, of course, will depend a great deal on the demand for legal services, particularly in the case of the specialist. Some lawyers may be appointed to judicial posts.

Advancement of lawyers who enter government service will be controlled by the regulations of the civil service concerned. Generally, there are several grades of positions through which they may advance.

EARNINGS

Lawyers in private practice derive their income from fees for legal services. The variation in individual earnings is very great. Some of the factors affecting their earnings are: number of years of experience; personal reputation; reputation of firm; and the size of the community. According to figures released by the Taxation Division of the Department of National Revenue, the reported incomes of 5,570 practising lawyers and notaries (about one-half the total number in Canada) were as follows:

	Number of Lawyers and Notaries	*Income Range*
	1,360	$15,000 and over
	1,140	10,000 to 15,000
	1,540	5,000 to 10,000
	1,530	under 5,000
Total	5,570	average $12,243

Many lawyers are employed on a salaried basis as assistants in law offices, as legal advisors in private businesses, or in government departments. Although figures for this group as a whole are not available, salaries for lawyers in the federal Civil Service range from $3,900 for inexperienced law school graduates to $9,500 and up for well-qualified persons.

Lawyers, particularly the older and more experienced, may have an opportunity to serve as members of the judiciary. Their annual salaries vary according to the court in which they serve. County and district court judges receive $10,500; provincial Supreme Court Judges, $16,900; and Chief Justices of the provinces, $18,500. Judges of the Supreme Court of Canada receive $22,500; and the Chief Justice of Canada, $27,500. (May 1957).

Some lawyers practise law on a part-time basis only; others use their legal training as a stepping-stone to highly remunerative positions as executives or administrators in private business and industry.

In some cases, lawyers are able to capitalize on their intimate knowledge of the business world and thus draw substantial income from sources other than the practice of law, such as investments in stocks, bonds or real estate.

ADVANTAGES AND DISADVANTAGES

Lawyers are respected members of the community who perform an important service for society.

Initial costs of preparing for and entering the profession are usually quite high. In this respect, however, most law schools have a number of bursaries and scholarships that are available to worthy students.

Newly admitted lawyers, whether in private practice or on salary, generally face a number of years of comparatively low earnings while gaining experience or building up a clientele. Furthermore, lawyers working on their own account and, in some cases, those employed in law firms, must accept the responsibility of providing themselves with adequate hospital, medical and

retirement funds. Once they are established, however, lawyers receive incomes that are either on a par with or better than those of most other professions.

Although lawyers usually keep regular office hours, there are many occasions when they must work long hours, often under the pressure of a deadline.

Legal training is an excellent preparation for executive or administrative positions in the business world or for a career in politics.

TRENDS

Number in the Profession

The 1951 Census of Canada recorded 597 judges and magistrates and 9,038 lawyers and notaries. This number is about two-thirds that of physicians and surgeons, and about double that of college professors.

That the number in the legal profession is considerably higher now, is evidenced by a statement from the Canadian Bar Association that, as of July 31, 1957, the various provincial societies reported a total membership of about 12,000. It was further stated that this figure probably does not include a number of qualified lawyers who are not in private practice.

Age Distribution

According to the 1941 Census, of the 477 judges and magistrates recorded, 386 or approximately 80 per cent were in the 55 years-and-over age group. In the 1951 Census it was found that this figure had dropped to about 66 per cent (396 out of 597), indicating an influx of young members into this field.

In other branches of the profession, however, it was found that the percentage of those 55 years of age and over had risen slightly to about 26 per cent in 1951 from 22 per cent in 1941.

Sex Distribution

The number of women in the legal profession is relatively small, although it is increasing. Many hold responsible positions and some have been appointed to the magistracy.

Geographic Distribution

The distribution by provinces in 1951 bears a reasonably close relationship to that of population. Ontario, with approximately 34 per cent of the total population, had 37.2 per cent of all lawyers; Quebec, with 30 per cent of the population, had 29.1 per cent of the lawyers.

Growth

Examination of the Census of Canada figures from 1921 to 1951 shows that the number of lawyers and notaries has consistently failed to keep pace with the growth of the population. The ratio of lawyers and notaries to total population has developed as follows:

1921	1 in 1,130
1931	1 in 1,217
1941	1 in 1,262
1951	1 in 1,401

A comparison of the 1951 Census figures of 9,635 lawyers and notaries in a population of 13,500,000 with those of the 1921 Census shows that while there has been a population increase of about 53% over this period there has been a corresponding increase of only 24% in the number of lawyers and notaries in the same period.

Outlook

Owing to the considerable enrolment of veterans in Canadian law schools following the war years, the number of persons graduating annually from these schools increased from 161 in 1946 to a high of 764 in 1950. This number decreased to 712 in '51, and 562 in '52. Since then, however, there has been a steady increase in the annual number of graduates and it is estimated, from available data, that approximately 700 will graduate from Canadian law schools in 1958.[1]

In discussing this profession, it is difficult to state categorically in terms of supply and demand just what the outlook will be for

[1] Figures regarding actual and estimated numbers of graduates in law were obtained from the Dominion Bureau of Statistics, *Survey of Higher Education.*

future law graduates. Needless to say, those in the top half of their class are not likely to experience much difficulty in obtaining desirable situations.

Several factors indicate that there will be ample opportunity for law graduates for a number of years. There is, for example, the fact that the number of practising lawyers has not kept pace with the growth in population over the last thirty years. Coupled with this is the tendency for modern living to become more complex, thereby increasing the need for legal services. Business and industry more and more are looking for recruits with legal training and background to fill executive positions.

Recognition of the need for more lawyers is evident in the recent expansion of training facilities in the Province of Ontario.

ORGANIZATIONS

The Law Society or Bar Association of each province governs the practice of law in that province. Persons desiring more detailed information about this profession should direct their inquiries to the secretary of the legal association of the province in which they are interested. The addresses of the various organizations are as follows:

The Law Society of Newfoundland,
Court House, St. John's, Nfld.

The Law Society of Prince Edward Island,
Charlottetown, P.E.I.

The Nova Scotia Barristers' Society,
Court House, Halifax, N.S.

The Barristers' Society of New Brunswick,
Parliament Buildings, Fredericton, N.B.
(The Saint John, N.B. Law Society is a local organization.)

The Bar of the Province of Quebec,
Room 305-307, 170 Dorchester St. East, Montreal, P.Q.
(The Bar of Montreal, Court House, Montreal, P.Q. is a local organization.)

The Board of Notaries of the Province of Quebec,
Court House, Montreal, P.Q.

The Law Society of Upper Canada,
Osgoode Hall, Toronto, Ont.
(The County of York Law Association is a local organization.)

The Law Society of Manitoba,
Law Courts, Winnipeg, Man.

The Law Society of Saskatchewan,
Court House, Regina, Sask.

The Law Society of Alberta,
206 Phillips Bldg.,
Edmonton, Alta.

The Law Society of British Columbia,
Court House, Vancouver, B.C.

The Canadian Bar Association is the national organization, with offices at 77 Metcalfe Street, Ottawa, Ont. This is not a licensing or governing body, membership being voluntary.

FURTHER READING

The Rules and Regulations of the Provincial Law Societies listed above.

The Canadian Bar Journal.

The Canadian Bar Review.

APPENDIX

Fees charged for the Law Course offered at three Ontario universities range from $337 to $410 per year. Accurate information about tuition fees may be obtained by writing to the Registrars of universities in which there is a Faculty of Law.

The fees that prospective lawyers must pay to the law society of the province in which they wish to practise may vary according to the rules and regulations of that society. As an example, the fees, other than tuition fees, payable by a graduate who wishes to be admitted to practice in Ontario, are:

For admission as a Student-at-Law (on entrance to the Bar Admission Course)	$101.
Fee for Call to the Bar and admission as a Solicitor	210.

As these fees may change from time to time, they should be verified with the Law Society of Upper Canada. Complete information about fees charged in the various provinces may be obtained from the respective provincial law societies.

"CANADIAN OCCUPATIONS" SERIES

Monographs and Pamphlets

The monographs listed below, accompanied by pamphlets, except in the case of numbers 11, 12, 13, 39, 42 and 43, have been published to date.

(1) Carpenter
(2) Bricklayers and Stone-Masons
(3) Plasterer
(4) Painter
(5) Plumber, Pipe Fitter and Steam Fitter
(6) Sheet-Metal Worker
(7) Electrician
(8) Machinist and Machine Operators (Metal)
(9) Printing Trades
(10) Motor Vehicle Mechanic
(11) Optometrist
(12) Social Worker
(13) Lawyer
(14) Mining Occupations
(15) Foundry Workers
(16) Technical Occupations in Radio and Electronics
(17) Forge Shop Occupations
(18) Tool and Die Makers
(19) Railway Careers

Careers in Natural Science and Engineering: (20-35, one booklet)

(20) Agricultural Scientist
(21) Architect
(22) Biologist
(23) Chemist
(24) Geologist
(25) Physicist
(26) Aeronautical Engineer
(27) ———
(28) Chemical Engineer
(29) Civil Engineer
(30) Electrical Engineer
(31) Forest Engineer and Forest Scientist
(32) Mechanical Engineer
(33) Metallurgical Engineer
(34) Mining Engineer
(35) Petroleum Engineer

(36) Hospital Workers (other than Professional)
(37) Draughtsman
(38) Welder
(39) Careers in Home Economics
(40) Occupations in the Aircraft Manufacturing Industry
(41) Careers in Construction
(42) Medical Laboratory Technologist
(43) Careers in Meteorology

Filmstrips

The Department of Labour has prepared, to date, the following occupational filmstrips in collaboration with the National Film Board. A manual has been prepared as an accompaniment to each filmstrip. These may be purchased from the National Film Board, Box 6100, Montreal, or from any one of its regional offices.

Plumber, Pipefitter and Steamfitter
Careers in the Engineering Profession
The Social Worker
Technical Occupations in Radio and Electronics
Bricklayer and Stone-Mason
Printing Trades
Careers in Natural Science
Careers in Home Economics
Motor Vehicle Mechanic
Mining Occupations
Draughtsman
Careers in Construction
Machine Shop Occupations
Sheet-Metal Worker
Careers in Meteorology

DEPARTMENT OF LABOUR
Economics and Research Branch
Canada 1958

EDMOND CLOUTIER, C.M.G., O.A., D.S.P.
QUEEN'S PRINTER AND CONTROLLER OF STATIONERY
OTTAWA, 1958

Cat. No. L43-1358

CANADIAN OCCUPATIONS

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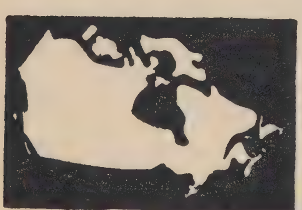
MINING OCCUPATIONS



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MONOGRAPH 14

DEPARTMENT OF LABOUR, OTTAWA

CANADIAN OCCUPATIONS

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MINING OCCUPATIONS

MONOGRAPH 14

HON. MILTON F. GREGG, V.C., MINISTER
ARTHUR MacNAMARA, C.M.G., LL.D., DEPUTY MINISTER

DEPARTMENT OF LABOUR, OTTAWA

45

FOREWORD

During recent years there has been a steadily increasing demand for up-to-date information on occupations.

This demand comes from youth faced with the need of choosing an occupation and of selecting the type of training required, from parents, teachers and other counsellors; from workers shifting to other occupations; from employment service officers; from directors of personnel and union officials, and from other quarters.

This series of monographs and an accompanying series of pamphlets, the latter containing similar information in a condensed form, are attempts to meet this demand.

These publications represent an expansion of an earlier series issued by the Department of Veterans Affairs to assist members of the armed forces returning to civilian life following the end of the war. These current series, designed for general use, cover a wide range of occupations, including professions. They indicate, among other things, the nature of the occupation or group of occupations, entrance and training requirements, working conditions and opportunities in each.

The monographs have been prepared by our research staff working on occupations, with the generous help and advice of officials of the Unemployment Insurance Commission, Vocational Training Branch of the Department of Labour, Dominion Bureau of Statistics, Provincial Departments of Education and of Labour, employers' associations, trade unions, professional associations, and other government and non-government bodies.

Grateful acknowledgement is made of this assistance and that obtained from numerous publications on occupations prepared in Canada and in other countries.

DIRECTOR,
Economics and Research Branch,
Department of Labour,

March, 1951.

OCCUPATIONS IN THE MINING INDUSTRY

(Other than Professional)

Photo N.F.B.

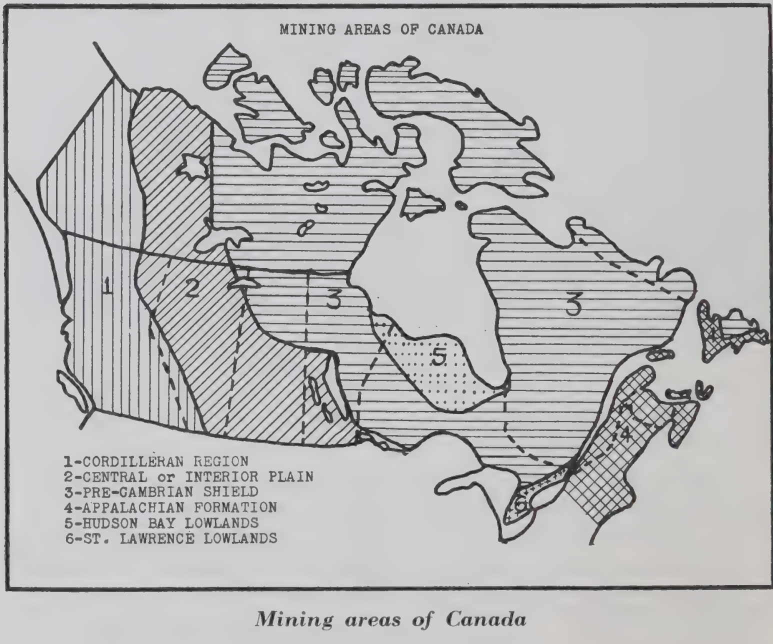
Prospectors at work

IMPORTANCE OF MINING

No occupation has more attraction for the adventurous, more glamour for the imaginative, greater rewards for the efficient and lucky, and a greater proportion of disappointments, than has the first job in mining—that of the prospector. His work, often based on a geologist's reports, scientifically followed up by the geologist and

the mining engineer, and developed by the diamond driller, the mine construction crews, the miners and technicians below and above ground, and the workers in the ore mills, has raised the value of Canadian mineral production from $300,000 in 1871 to $890,000,000 in 1949. The mining industry in February, 1950, employed nearly 85,000 persons; nearly 19,000 others were engaged in the reduction of base metal ores to a form suitable for manufacturing.

The name "Pre-Cambrian Shield" is applied to a vast area, largely in North-eastern Canada, underlain by Pre-Cambrian rocks. This part of Canada has an area of over two million square miles. It includes Labrador, Quebec north of the St. Lawrence Lowlands, and all of Ontario north of the city of Ottawa, west to the southern tip of Georgian Bay, then following a line northwest by Lake Winnipeg to Lake Athabasca, Great Slave and



Mining areas of Canada

Great Bear Lake to the Arctic Ocean. It is broken only by an extensive plain along the south-west coast of James and Hudson's Bay, similar plains in some of the northerly Arctic islands, and the densely-populated areas of Quebec along the St. Lawrence and of Ontario between the Ottawa and St. Lawrence rivers and between Lake Ontario, Lake Erie and Lake Huron. It is in a small proportion of this great area already explored that Canada has developed mining enterprises which make this the greatest hard-rock mining country in the world, with a technique specially adapted to this type of industry. What may result from further exploration is impossible to imagine; enterprises now under way in Labrador and Ungava have, in iron alone, potentialities of major importance. Part of Newfoundland is in this formation.

Canada has, however, other areas producing both metallic and non-metallic minerals in increasing quantities, and having possibilities yet to be developed. The *Cordilleran region*, comprising a wide strip of South-western Alberta and the major part of British Columbia and the Yukon territory, contains gold, silver, lead, zinc, mercury, copper, tungsten, arsenic, coal and oil; over 67 per cent of our coal resources are in this region. The *Central Plain*, lying between the Cordilleran region and the Pre-Cambrian Shield, supplies low-grade coal, oil, sodium sulphate and other chemicals, gypsum, bentonite, and salt. The *St. Lawrence lowlands* of Quebec and Ontario provide salt, gypsum, graphite, talc and feldspar. The *Appalachian formation* of the Maritimes is one of the principal coal-mining areas of Canada, and also contains gypsum, salt, barite, dolomite and some gold and silver; in Quebec an extension of this area is a major source of asbestos.

It is the Pre-Cambrian Shield, nevertheless, which is the great producer of metallic minerals. Gold, useful for adjusting foreign exchange, and having some commercial uses, is a major factor in the mining economy of the area. The greatest supply of nickel in the world comes from one small region in the southern portion of the "Shield". Silver, cobalt, uranium, platinum and other rare metals,

copper, iron, lead, zinc and titanium are all products found in widely varying locations. What modern methods

Going on shift —
Note cage (right centre) and timbering props (on truck)

and a greater supply of risk capital may reveal is beyond imagination.

New mines are found, worked, and exhausted, but the companies operating them usually maintain a continuity of capital in the field by obtaining interests in newer developments. Much of the profit in mining is thus retained in the industry for its expansion.

Mining shares with agriculture, pulp and paper manufacturing, and lumbering in providing exports to balance our dollar economy, thus enabling us to import the fuel, fruits, vegetables and textiles we do not or cannot produce in sufficient quantity for our domestic needs.

Canada uses 40,000,000 tons of coal annually, but mined only 19,275,000 tons in 1949, the peak year to date. The coal mining industry is seeking ways and means to increase the demand for Canadian coal, the second largest supply in the world. New petroleum discoveries give rise to the hope that we may yet produce a major proportion of our consumption of this essential mineral.

PERSONNEL EMPLOYED

The personnel employed in mining may be divided into five groups:

(a) *Professional:* (geologists, mining engineers, petroleum engineers and metallurgists). These are dealt with in special chapters of our publication *Careers in Natural Science and Engineering*. Administrative and executive officials of mines are often members of these professions.

(b) *Technicians* include prospectors, assayers, and laboratory workers, as well as mine foremen and captains, and in coal mines fire bosses.

(c) *Skilled workers* cover a wide field.

Diamond drillers operate the drills which expose the geological structure of the ore, from surface or underground; *tool* or *steel sharpeners* maintain the drills; *hoistmen* operate the cages or skips in the shaft; *millwrights* set up machinery; *carpenters* build and maintain

the various structures; *electricians* install and maintain electrical equipment; *machinists* make and repair machine parts; *plumbers and pipefitters* install and maintain water, air, and ventilating systems. *Blacksmiths* are also employed. Eastern coal mines have *stationary engineers* and *firemen* for their power plants.

Miners work on the actual removal, by drilling and blasting, or by hand tools, of the ore or other mineral. *Samplers* take samples of the ore.

Timbermen look after the roofing and "shoring up" of underground workings and the building and maintenance of chutes. *Powdermen* are in charge of explosives and their use. *Compressormen* look after the air supply (for air-driven tools and frequently for ventilation).

Since some metal and non-metal mines are open pits, large numbers of *mechanical shovel* and *bulldozer operators*, as well as *truck drivers* may be employed. In the mill, *crushermen*, *filtermen*, *flotation operators* and *solution men* are skilled workers.

The mining of petroleum, until recently a relatively minor part of our mineral production, is now being developed on an expanding scale. An entirely different group of men is employed here, such as *riggers*, *drillers* with various functions, and *specialists in the use of high explosives*.

Coal and metal mines need *pumpmen* to keep water down.

Clerical workers are in proportion to the size of the enterprise.

(d) *Semi-skilled workers* include the "*mucker*" or nowadays generally *mucking machine operator* who removes, and usually loads on a small car, the material the miner has dislodged. The individual miner and the mucker often work as a team. *Miner's helpers, workers in the mill*, and assistants to the various skilled tradesmen, as well as those performing jobs specialized in a particular mine, are usually "semi-skilled" intending to advance to "skilled".

Cage and skip tenders, who look after loading and unloading at different levels, *chute blasters* who keep ore moving, *motormen* on subterranean electric railways, *deckmen,* who supervise loading and unloading of men, supplies and ore trucks onto and from cages, *trackmen* who maintain rail lines, are semi-skilled underground workers. In some mines *trammers* handle the trucks. Coal mines using horses have *stablemen.*

(e) *Labourers* may be engaged in routine or manual work in so many capacities that it would be cumbersome to specify them. Such employment would vary greatly in different types and sizes of mining operations. Some work underground, others on the surface.

Since the skilled trades, such as electrician, machinist, blacksmith and carpenter, are common to many industries, they will not be further discussed in this monograph.

The *prospector,* the forerunner in the mining industry, is frequently an independent individual with an elementary knowledge of geology, a keen interest in his work, an incurable optimism, and an ability to live and work under hardships. He has adapted himself to aeroplane transport and the use of some of the new methods; he may now work on a wage-and-share basis for an employer company, attend classes in geology, or even courses in a mining school. However, he will still require the same qualities of endurance, optimism, and intelligent observation which distinguish the "old-timers" who survive. He may eventually be replaced by professional groups using modern scientific devices.

The British Columbia government has, since 1943, appropriated money to "grubstake" prospectors. The sums allotted to individuals have varied, from year to year, averaging $205 in 1943 and $391 in 1948. About a hundred grants have been made in each year. The applicant must be a British subject, hold a "full miner's certificate" and have been resident in the province for a year. (An exception to the last requirement is made in the case of honourably discharged veterans).

The "key man" is the *miner,* working directly on the face of the deposit. His work is, of course, varied in technique according to whether he is producing coal, metallic ores, or non-metallic minerals other than coal. In each of these three major divisions of mining, the work may be in open pits, or in tunnels reached by a deep vertical or inclined shaft, or in tunnels to which a sloping or horizontal "adit" driven into a hillside leads. In some placer gold mining operations, "dredge" methods are used to extract the metal from sand and gravel by means of water and gravity; the miner here may be a dredge master, the operator of a hydraulic jet, or just a prospector operating a gold pan or a simple ribbed wooden flume.

The *coal miner* may operate mechanical drills and cutting machines, or may use hand drills and a hand pick. An increasing number of coal mines use cutting machines and mechanical loaders. The *hard-rock miner* generally works with a percussion drill, but the diamond drill is becoming of greater importance for blast hole drilling (both are normally operated by compressed air for underground operations). He may use hand tools at times. Each mineral and each ore, and in fact each formation may require an adaptation of technique.

The provinces provide for certification of miners, and without the appropriate certificate no man may work on a coal face, or handle explosives underground.

A glossary of the occupations of many of the men employed in coal mining and hard-rock mining is given at the end of the monograph.

QUALIFICATIONS

A good physique, freedom from any pulmonary, respiratory or other handicapping disability, stable mentality, absence of claustrophobia, ability to work as one of a team, mental alertness, resourcefulness, and adaptability to changing living and working conditions, are qualities which will fit a man for work in hard-rock or coal mining. The requirements for open-pit operations are perhaps less exacting.

There is no formal educational standard; the mines have always been manned by men of several nationalities and cultures; "Cousin Jacks" from Cornwall, Jugoslavs, Russians, Poles, and native English and French-speaking Canadians have long worked together in harmony. Recently some hundreds of Displaced Persons have proved their usefulness in our hard-rock mines.

TRAINING

Essential training is received on the job. Few miners have ever attended any formal course. Some companies, notably Hollinger at Timmins, have practical training schools in the mine itself. In recent years, prospectors have had, from time to time, opportunities to attend courses on their work. Several of the provinces have for many years given brief lectures on mineralogy in towns in mining areas. The British Columbia-Yukon Chamber of Mines conducts an annual course in prospecting.

There are, however, schools of mining such as the Provincial Institute of Mining, Haileybury, Ontario, which is attended by many Northern Ontario secondary school graduates. This school awards diplomas and conducts one and two-year courses, commencing in September and ending in May. Prerequisites are Grade X for the two-year course; Grade XII for the one-year. Miners successful in these courses are likely to attain technical positions.

The Quebec School of Mines at Val d'Or gives short courses in practical underground work. This school has not been in continuous operation, and enquiry should be made of the Provincial Department of Mines as to the date of the next course.

The Lakehead Technical Institute, Port Arthur, Ontario, opened in September, 1948, a two-year diploma course in Mining (the course is technical). Admission requirements are Ontario Secondary School Graduation Diploma or equivalent, or approved industrial experience plus completion of an acceptable course. Entrance examination and aptitude tests may also be required.

In some years Laval University has provided a five-week day course, instruction in French, and the University of Toronto has conducted a fifteen-week part-time course. Enquiry should be made of the proper Provincial Departments as to any future courses along the lines indicated above.

ENTRY

The National Employment Service has facilities to assist those desiring to enter this industry.

For underground work it is usual to commence as a "mucker" or as a "mine beginner" (labourer).

Surface and mill workers begin as labourers.

Prospectors usually begin as helpers or partners of working prospectors or as general handymen with geological survey parties.

Diamond drillers and technicians generally begin as helpers.

The members of skilled crafts employed are, of course, trained in the manner required by their own trades, chiefly apprenticeship.

Technicians, such as assayers, may be junior professional men, or graduates of a mining school. Some have been selected from surface, mill or underground workers with superior education.

In coal mining, an apprenticeship system has been set up in Cape Breton to train miners for certification.

PROMOTION

The line of promotion is from mucker to helper (in coal mines helper or trammer), to miner, timberman, powderman, blaster, etc. Skilled miners may become shift bosses, foremen, or mine captains.

Labourers in the mill may work up to crushermen, filtermen, shift bosses or foremen, possibly to superintendents.

Other surface workers may become foremen.

In coal mining there is, of course, no mill employment to provide advancement for labourers. In open-pit opera-

tions, usually non-metallic (though Steep Rock iron and Sudbury nickel deposits are being worked in this manner), the production employees are largely churn drillers, who bore holes for blasting, or operators of excavating machines and of trucks. There are also the necessary skilled tradesmen such as electricians, machinists and pipefitters. The remaining employees are mostly in the unskilled labour class, (apart from, of course, clerical, professional and administrative staffs).

Photo Can. Govt. Motion Picture Bureau

Lunch-time, 2,000 feet below the surface — Note railway, timbers, electric light.

EARNINGS

Average weekly earnings of mine employees increased from $28.68 in 1941 to $51.81 in 1948. As of December 1st, 1949, employees of coal mines received on the *average*

$53.66, metallic mines $56.28, and non-metallic mines $49.72. *Average* weekly *salaries and wages* in mining in Newfoundland were reported as $49.39 as at October 1st, 1950. For Canada generally they were $54.85 as at that date.

Wages vary considerably according to the location of the mine and to the specific tasks performed. They are well above the average for all industries.

Men employed underground are normally on a production bonus in addition to a cost-of-living bonus and basic pay. Mine workers may be paid by the day, the week, the month or by contract.

Relative rank in pay, from the lowest upward, is roughly as follows: (1) Mine helpers, labourers; (2) Cage tenders, motormen, samplers, trackmen, chute blasters and scalers, compressormen, timbermen's helpers, muckers, deckmen, solution men, filtermen; (3) Machinists, hoistmen, timbermen, blacksmiths, carpenters, miners, pipefitters, crushermen, tool sharpeners; (4) Electricians.

The following tables, taken from the "Annual Report on Wage Rates and Hours of Labour in Canada", October 1949, show the earnings of many of the employees as of that date.

WAGE RATES AND HOURS OF LABOUR IN THE MINING INDUSTRY, CANADA, 1949

(1) Coal Mining

Occupation and Locality		Average Wage Rate Per Day	Range of Rates Per Day
		$	$
Standard Hours			
	Per Week		
Nova Scotia	40–48		
New Brunswick	48–54		
Alberta	40–48		
British Columbia	40–44		
BLACKSMITH			
Canada		9.84	....
Nova Scotia		9.02	8.69–10.16
Alberta		10.90	10.42–11.05
British Columbia		10.85	10.56–11.05
BRATTICEMAN			
Canada		9.53	....
Nova Scotia		8.32	8.24– 8.62
Alberta		10.79	10.74–10.95
British Columbia		10.87	10.74–10.95
CARPENTER			
Canada		9.58	....
Nova Scotia		8.71	8.64– 8.78
Alberta		10.89	10.52–11.05
British Columbia		10.90	10.84–11.05
DRIVER			
Canada		10.21	....
Nova Scotia		9.29	8.14–10.73
Alberta		10.68	10.56–10.68
British Columbia		10.56	....
HOISTING ENGINEER			
Canada		9.49	....
Nova Scotia		8.64	8.14– 9.48
Alberta		10.72	10.14–11.11
British Columbia		10.79	10.35–11.11

WAGE RATES AND HOURS OF LABOUR IN THE MINING INDUSTRY, CANADA 1949—Continued

(1) Coal Mining

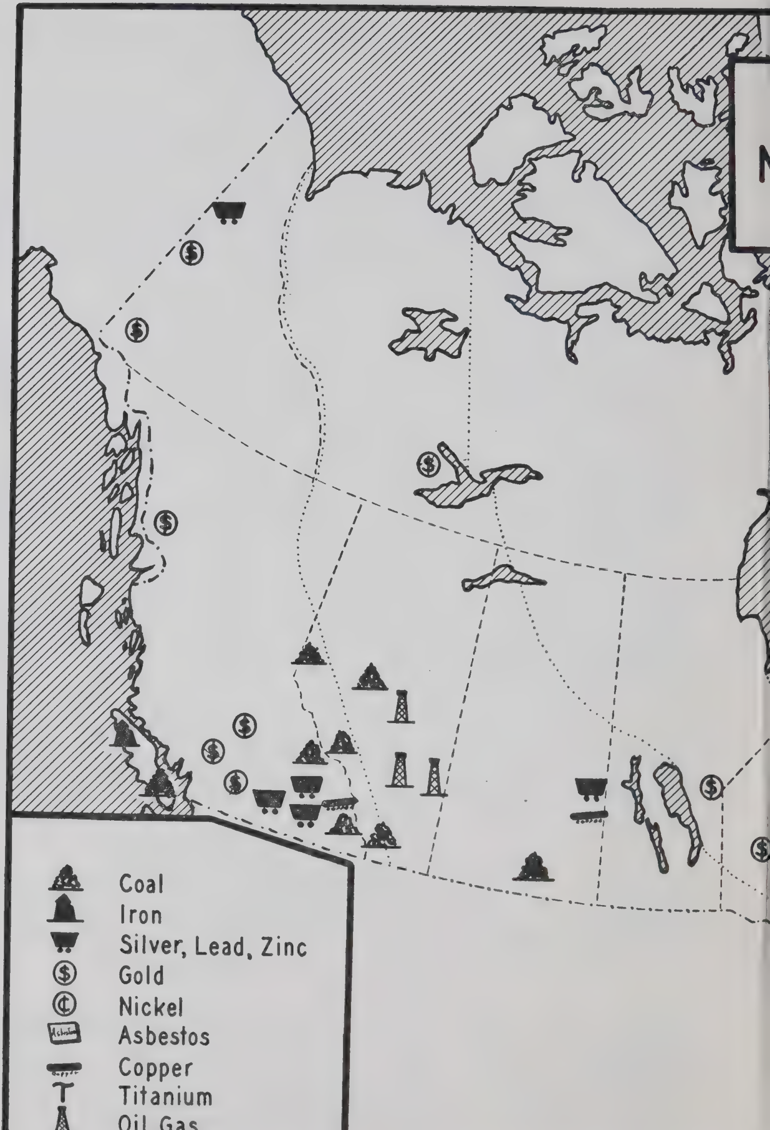
Occupation and Locality	Average Wage Rate Per Day	Range of Rates Per Day
	$	$
LABOURER		
Canada	8.96	....
Nova Scotia	8.14	7.55– 8.74
New Brunswick	6.30	....
Alberta	10.07	9.79–10.08
British Columbia	9.54	8.16–10.07
MACHINIST		
Canada	10.30	....
Nova Scotia	9.75	8.69–10.16
Alberta	11.11	10.52–12.05
British Columbia	10.92	10.84–11.05
MINER, CONTRACT (1)		
Canada	12.65	....
Nova Scotia	11.75	10.60–12.50
New Brunswick	8.42	7.43– 9.62
Alberta	14.20	10.95–17.53
British Columbia	15.19	12.97–17.26
MINER, DATAL		
Canada	10.68	....
Nova Scotia	9.08	8.14– 9.24
Alberta	10.95	10.74–11.67
British Columbia	11.30	....
MINER, MACHINE		
Canada	10.92	....
Nova Scotia	9.37	8.14–11.90
Alberta	11.94	10.07–14.60
British Columbia	11.24	10.74–12.47
PUMPMAN		
Canada	8.89	....
Nova Scotia	8.67	8.64– 8.77
Alberta	10.37	9.52–10.95

(1) Rates shown are average straight time daily earnings.

WAGE RATES AND HOURS OF LABOUR IN THE MINING INDUSTRY, CANADA 1949
(2) Metal Mining

Occupation and Locality	Basic Rates		Straight Time Earnings[1]	
	Average Wage Rate Per Hour	Range of Rates	Average Earnings Per Hour	Range of Earnings
	$	$	$	$
Standard Hours per Week: 48; British Columbia 44				
UNDERGROUND				
Cage and Skiptender				
Canada	1.05	....	1.10	....
Quebec	.97	.90—1.10	1.03	.95—1.11
Ontario	1.06	.93—1.30	1.12	1.01—1.24
Manitoba	1.19	.99—1.37	....	....
British Columbia	1.12	1.03—1.25	1.26	1.13—1.44
Chute Blaster				
Canada	1.06	....	1.30	....
Quebec	.93	.80—1.08	1.02	.93—1.05
Ontario	1.04	.95—1.30	1.21	1.00—1.49
Manitoba	1.09	.95—1.24	1.30	1.02—1.62
British Columbia	1.24	1.01—1.25	1.62	....
Deckman				
Canada	.95	....	1.07	....
Quebec	.92	.80—1.05	1.03	.90—1.11
Ontario	.95	.87—1.00	1.09	.98—1.32
Manitoba	1.06	.86—1.16	....	....
Hoistman				
Canada	1.13	....	1.33	....
Quebec	1.07	.95—1.24	1.17	1.15—1.22
Ontario	1.13	1.01—1.38	1.15	1.05—1.26
Manitoba	1.22	.92—1.37	....	....
British Columbia	1.16	1.04—1.33	1.30	1.14—1.45
Miner				
Canada	1.06	....	1.36	....
Quebec	.97	.90—1.08	1.22	1.07—1.40
Ontario	1.06	.95—1.24	1.37	1.19—1.52
Manitoba	1.14	.95—1.25	1.54	1.29—1.75
British Columbia	1.18	1.03—1.33	1.49	1.13—1.74

[1] Basic Rates Plus Incentive Bonus for Straight Time.


Coal
Iron
Silver, Lead, Zinc
Gold
Nickel
Asbestos
Copper
Titanium
Oil, Gas


RINCIPAL DEVELOPED
NG AREAS OF CANADA
SELECTED MINERAL RESOURCES

WAGE RATES AND HOURS OF LABOUR IN THE MINING INDUSTRY, CANADA 1949—Continued

(2) Metal Mining

Occupation and Locality	Basic Rates		Straight Time Earnings[1]	
	Average Wage Rate Per Hour	Range of Rates	Average Earnings Per Hour	Range of Earnings
	$	$	$	$
UNDERGROUND —Continued				
Miner's Helpers				
Canada	.91	....	1.13	....
Quebec	.89	.80—1.00	1.02	.92—1.10
Ontario	.91	.85— .93	1.17	1.00—1.29
Manitoba	1.05	.89—1.15	1.32	1.23—1.79
British Columbia	1.03	.99—1.08	1.30	1.13—1.45
Motorman				
Canada	1.03	....	1.22	....
Quebec	.93	.86—1.08	1.04	.97—1.13
Ontario	1.05	.93—1.24	1.26	1.00—1.49
Manitoba	1.14	.89—1.25	1.57	1.56—1.62
British Columbia	1.06	.98—1.17	1.20	1.08—1.34
Mucker and Trammer				
Canada	1.01	....	1.23	....
Quebec	.93	.80—1.05	1.04	.86—1.21
Ontario	1.03	.88—1.24	1.28	.98—1.49
Manitoba	1.10	.89—1.15	1.46	.93—1.59
British Columbia	1.02	.95—1.07	1.24	1.05—1.42
Pipemen				
Canada	1.10	....	1.10	....
Quebec	.98	.89—1.20	....	....
Ontario	1.11	.95—1.24	1.11	.95—1.57
Manitoba	1.26	1.11—1.33	....	....
British Columbia	1.17	1.08—1.41	1.24	1.13—1.39
Sampler				
Canada	.98	....	1.08	....
Quebec	.95	.90—1.08	....	....
Ontario	.98	.95—1.00	1.08	1.01—1.24
British Columbia	1.10	1.00—1.17	1.12	1.01—1.30

(1) Basic Rates Plus Incentive Bonus for Straight Time.

WAGE RATES AND HOURS OF LABOUR IN THE MINING INDUSTRY, CANADA 1949—Continued
(2) Metal Mining

Occupation and Locality	Basic Rates		Straight Time Earnings(1)	
	Average Wage Rate Per Hour	Range of Rates	Average Earnings Per Hour	Range of Earnings
	$	$	$	$
UNDERGROUND—Continued				
Timberman				
Canada	1.12	....	1.38	....
Quebec	.94	.85—1.08	1.00	.94—1.05
Ontario	1.15	.96—1.24	1.40	1.13—1.49
Manitoba	1.14	.95—1.25	....	....
British Columbia	1.21	1.03—1.33	1.55	1.13—1.70
Trackman				
Canada	1.06	....	1.11	....
Quebec	.94	.90—1.05	1.01	.94—1.11
Ontario	1.07	.95—1.24	1.14	1.02—1.22
Manitoba	1.15	.95—1.25	....	....
British Columbia	1.17	1.08—1.21	1.29	1.09—1.39
SURFACE AND MILL				
Blacksmith				
Canada	1.16	....	....	....
Quebec	1.04	.90—1.15	....	....
Ontario	1.18	.98—1.38	....	....
Manitoba	1.19	.96—1.42	....	....
British Columbia	1.24	1.10—1.41	....	....
Carpenter				
Canada	1.18	....	....	....
Quebec	.98	.84—1.09	....	....
Ontario	1.18	.98—1.33	....	....
Manitoba	1.33	1.11—1.42	....	....
British Columbia	1.27	1.10—1.41	....	....
Crusherman				
Canada	1.02	....	....	....
Quebec	.92	.78—1.05	....	....
Ontario	1.01	.89—1.24	....	....
Manitoba	1.22	.99—1.28	....	....
British Columbia	1.09	1.02—1.13	....	....

(1) Basic Rates Plus Incentive Bonus for Straight Time.

WAGE RATES AND HOURS OF LABOUR IN THE MINING INDUSTRY, CANADA 1949—Continued

(2) Metal Mining

Occupation and Locality	Basic Rates		Straight Time Earnings(1)	
	Average Wage Rate Per Hour	Range of Rates	Average Earnings Per Hour	Range of Earnings
	$	$	$	$
SURFACE AND MILL—Continued				
Electrician				
Canada	1.23	....	....	....
Quebec	1.03	.90—1.20	....	....
Ontario	1.25	.98—1.38	....	....
Manitoba	1.36	1.11—1.47	....	....
British Columbia	1.24	1.08—1.41	....	....
Labourer				
Canada	.97	....	....	....
Quebec	.79	.70— .86	....	....
Ontario	1.00	.83—1.08	....	....
Manitoba	1.03	.81—1.11	....	....
British Columbia	1.02	.93—1.08	....	....
Machinist				
Canada	1.22	....	....	....
Quebec	1.05	.90—1.20	....	....
Ontario	1.22	1.01—1.38	....	....
Manitoba	1.33	1.01—1.42	....	....
British Columbia	1.31	1.14—1.41	....	....
Millman				
Canada	1.04	....	....	....
Quebec	.92	.83—1.05	....	....
Ontario	1.02	.91—1.27	....	....
Manitoba	1.25	.99—1.42	....	....
British Columbia	1.09	1.01—1.21	....	....
Steel Sharpener				
Canada	1.10	....	....	....
Quebec	1.01	.90—1.15	....	....
Ontario	1.11	.96—1.24	....	....
Manitoba	1.27	1.20—1.35	....	....
British Columbia	1.19	1.07—1.29	....	....

(1) Basic Rates Plus Incentive Bonus for Straight Time.

Photo Nott and Merrill

There is a comradeship and general cheerfulness among miners

ADVANTAGES AND DISADVANTAGES

A major advantage is the reasonably high rate of pay. Anyone who has lived in a mining town will admit, too,

that there is a comradeship and a general cheerfulness among miners which is very noticeable. Hard-rock mining towns are rarely far from good hunting, fishing and boating territory. The industry is highly organized by strong unions.

In recent years the welfare of the miner has been given much consideration by employers and by unions, with the result that there is a trend toward holidays with pay and provisions for hospitalization and other medical insurances.

There are disadvantages, particularly in underground work. Some mines are wet or damp, and special clothing must be worn. Working space in coal mines may be

Photo N.F.B.

Working at a chute — Note safety precautions

cramped, and as mines become deeper they are increasingly hot. There are risks of rock falls, explosions, accidents, fire, and, in coal mining, gas. However, through study of accidents and their causes, safety regulations are in force which should further reduce the hazards.

Living costs are sometimes high in mining towns, since construction costs exceed those in most localities, and in many cases local supplies of agricultural produce are lacking, and supply centres for all goods may be distant. In some places, particularly new mining centres, company houses are available for married couples, and single persons are boarded at reasonable rates. Company stores often supply many of the essentials at favourable prices.

ORGANIZATIONS

Over fifty thousand workers in the mining industry belong to unions. Two of the largest unions in Canada, the United Mine Workers of America (C.C.L.) and International Union of Mine, Mill and Smelter Workers (Ind.), are largely responsible for organizations in coal mining and metal mining respectively. Directly chartered unions of the Canadian Congress of Labour are also active in metal mines. Finally, the Fédération des Employés de l'Industrie Minière has its membership in the mines of Quebec, particularly the asbestos mines.

TRENDS IN THE INDUSTRY

The past expansion of this industry has been indicated above. Present activity, in exploration, installation of machinery, provision of capital, and recruiting of manpower, is based on comparatively high prices, not always maintained for base metals, for the products of mines; gold—with a set dollar value in United States money—is over 80 per cent higher in Canadian funds than it was during the mining boom of the 1920's. Minerals associated with the main ore and formerly thrown away, such as cobalt, are in demand. The search for radioactive

ores has given a new stimulus to prospecting. Air transport, and the use of bulldozers and other road-making machinery, have simplified problems that formerly delayed or prevented the development of new finds. The supply of risk capital in the mining market has also had a stimulating effect on new development.

The increasing price and, at times, unstable supply of United States coal, on which Canada has so long relied, have given an opportunity for a market in Central Canada for Alberta's product, and if increased supplies of both capital and labour are forthcoming, the great Canadian reserves of coal, much of which is of fairly high grade, may be the basis of an industry considerably greater than the present one, as well as helping the exchange situation of the Dominion. The potentialities of the coal industry as a raw material basis for synthetic gasoline may also have future importance. Oil is already, however, a serious competitor with coal for domestic, railroad and ship fuelling.

Development of major Canadian iron deposits has long been delayed owing to their location far from supplies of smelting fuel. New technological advances in smelting, using hydro-generated electricity for heating, and with a different type of furnace, seem likely to solve this problem. Canadian ore supply has recently for the first time become equal to the ore consumption of Canadian blast furnaces; for reasons of accessibility, we actually export and import ore in about equal amounts. Whether it will be possible to supply coke, still necessary in the smelting process, from Canadian-mined coal seems to be uncertain at present. If a free movement of coking grades of Western and Maritimes coal to Central Canada could be made economically competitive with the current and traditional movement from the U.S.A., it would seem that both coal and iron mining would expand, together with the now limited steel industry.

A major problem in gold mining is the cost of recovery, which varies according to equipment, rock formation, and the distribution of the gold. Some mines can operate profitably on $5 a ton ore, while others lose on more

valuable ore. Generally speaking, a large body of low-grade ore can be milled at a profit, especially if silver, copper, or other by-products are worth recovering.

New methods in the treatment of nickel ore may lead to exploitation of low-grade undeveloped deposits. By-products of many ores are now valuable sources of income.

Employment Trends

In the unlamented 1930's freight trains on the Northern Ontario railways swarmed with jobless transients, many of them skilled tradesmen, seeking access to the mining towns of the north. In one town over a thousand potential workers were, at the same time, awaiting the chance of a low-paid job in a unionless mine. 1939 changed all that. The same town found a large percentage of its workers forsaking it in uniforms—by 1941 empty houses and apartments were being offered for sale or rent at low figures. Since gold, not an important war commodity, had no labour priority, this industry languished, carrying on largely with a reduced staff, most of whom were in the older age bracket. During the war and immediately following this, the demand for and the price of base metals rose sharply. Gold was once more in the ascendant as an exchange factor; the mines had to recruit again to make up for their war casualties, to replace those who preferred another occupation, and to carry out long-delayed operational expansions.

Without enough skilled miners, other workers could not be added. Immigration from Britain and Eastern Europe had supplied the main body in the past; the present and future had to depend on trainees.

The transfer of suitable persons from areas of low employment, and the recruiting of selected Displaced Persons, have partly filled the gap. Making employment more attractive has also been the means of improving the situation. The wage averages quoted earlier in this monograph are one index of this last trend. The organization of the workers, in pre-war years handicapped by a labour surplus, is now almost general.

It must be remembered that the trend of employment in an individual mining operation is dependent on the economic standing of the operating company. If it runs out of working capital, or if the mill results are showing an unprofitable recovery, or if accidents make operation hazardous, employment may cease. Fluctuating prices for copper, zinc, lead and other base metals also affect production and employment.

It looks, however, as if a skilled, certificated hard-rock or coal miner is likely to find employment awaiting him in some part of Canada for several years to come. The introduction of mechanical cutters and loaders into coal mines may have an effect on the employment of certain groups of workers, if it becomes more extensive than at present.

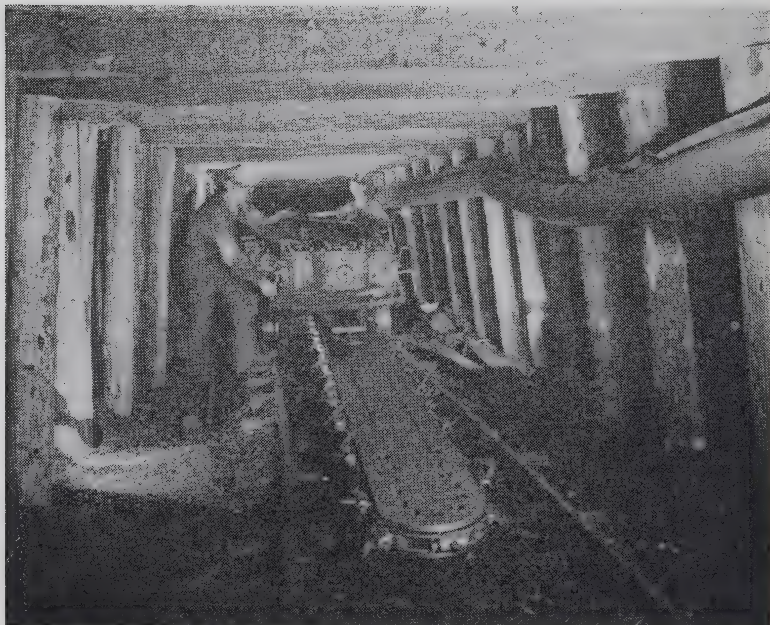


Photo N.F.B.

A coal-cutting machine in a western mine—
Note ventilating tube on right

CONCLUSION

In few industries are there as many opportunities for physically and mentally suitable young men to obtain skilled status and a reasonably high and steady rate of pay without years of low-paid apprenticeship. Few industries are so capable of expansion. While few jobs have as trying working conditions, nevertheless few industries

Photo N.F.B.

Pause for refreshment

have as harmonious relations between workers of all nationalities and backgrounds. In the prospecting aspect of mining, adventure, the element of chance, and an open-air life attract many of the native-born.

Mine work, except in some less modern coal mines, has emerged from the "pick and shovel" era to that of mechanization; mine workers are among the most interesting and friendly of all industrial groups.

PUBLICATIONS

Ontario Mining Association, 320 Bay Street, Toronto, *The Miner at Work* (1949).

For general current information on hard-rock mining, the *Northern Miner*, weekly, Toronto, is useful to indicate developing trends. Financial publications, and the financial columns of the daily press, may be followed to note the expansion or contraction of various mining areas. "Feature" articles often appearing in magazines and in Sunday supplements of Canadian papers make a useful study in relation to this industry.

The Story of Canada's Coal (C. Gerow, M.B.E.), Canadian Coal Operators' Association, Ottawa, 50c., gives much detail on our coal industry.

The Canadian Mining Journal is a monthly magazine of an industrial and technical character. (National Business Publications, Gardenvale, Quebec).

British Columbia Department of Education (B.C. Occupations series) *The Mining, Metallurgical and Chemical Industries, 1950*—contributed by the Consolidated Mining and Smelting Co. of Canada, Ltd. This gives much useful information on base metal mining and smelting, and on chemical by-products. Very well illustrated.

Term	Coal or Metal Mining	Description
Blacksmith	**Both**	**Forges metal parts for the repair of machines and equipment; shapes and sharpens tools; tempers metal parts of tools. May fit or reset horseshoes.**
Bratticeman (Ventilation man)	**Coal**	**Hangs canvas curtains, or erects partitions of wood, brick or cement in underground passageways to control ventilation in a mine.**
Brusher	**Coal**	**Increases height of passageways and clears away loose materials to facilitate work, and to prevent injury to workmen. May drill holes in roof and blast down sections required.**
Cage Tender	**Both**	**Controls operation of the cage between intermediate levels and the surface, by signalling the Hoistman with buzzer, bell or telegraphic equipment. Directs loading and transportation of men, supplies and mine cars in cages or ore skips.**
Chute Blaster	**Metal**	**Keeps ore moving in large chutes, blasts larger pieces of rock or ore in chutes, and bars or blasts hung up chutes. Assists and directs the removal of ore from chutes.**
Crusher Operator Crusherman	**Metal**	**Operates a crushing machine which breaks up large lumps of ore preparatory to refining. May assist in feeding ore to crusher.**
Compressorman	**Both**	**Operates and maintains air compressor driven by a steam, electric, or gasoline power unit, to supply compressed air for operation of pneumatic tools and equipment.**
Deckman	**Both**	**Loads and unloads ore cars and supplies from cages, responsible for clearing deck.**

Term	Coal or Metal Mining	Description
Diamond Driller	**Metal**	**Sets up and operates a diamond drill, to drill shot holes or to obtain core sample for exploration. Lubricates and makes minor repairs to drill. May set diamonds in bit.**
Engineer, Stationary	**Both**	**Operates and maintains stationary engines and other mechanical equipment such as generators, compressors, motors and turbines. Lubricates, adjusts and makes minor repairs to equipment. Must hold a Provincial Government Certificate. May fire boilers or supervise a stationary Fireman.**
Fire Boss **(or Mine Examiner)**	**Coal**	**Examines all areas of mine for gas; maintains safe conditions for Miners, endeavours to prevent fires.**
Filter Operator	**Metal**	**Operates a drum filter used to extract the liquid from the colloidal suspension of a mineral. Controls the flow of the solution into the filter tank. May see to the loading of ore or tailings into cars.**
Fireman, Stationary **(Boilerman)**	**Both**	**Fires stationary boiler to generate heat or power for industrial plant either by hand or mechanical stoker methods, maintains water at proper level and observes prescribed safety regulations.**
Flotation Operator	**Metal**	**Tends the operation of a series of flotation cells to separate valuable minerals from gangue. Regulates speed of agitators in the flotation cells and the flow of pulp and reagents; sees that proper separation takes place.**
Grinding Mill Operator	**Metal**	**Operates a ball mill in which ore is ground to required fineness. Regulates the flow of ore and water into the mill. Lubricates and makes minor repairs to the mill.**

Term	Coal or Metal Mining	Description
Hoistman	**Both**	**Operates surface or underground hoisting machinery to move cages or skips between different levels, and to or from the surface of the mine. Controls these movements as directed by signals of cage or skip tenders.**
Loader and Bucker	**Coal**	**Bucks coal as it passes down chutes. Shovels coal and waste material into mine cars or onto conveyor belts. May push loaded cars to haulageways.**
Loader, Machine	**Coal**	**Sets up and operates electrically-powered or compressed-air-powered machines used for loading cut and blasted coal into mine cars or onto conveyors.**
Machine Cutter **(Coal Cutter operator)** **(Cutting machine runner)**	**Coal**	**Sets up and operates a cutting machine used in the recovery of coal from the working faces. Adjusts and makes minor repairs to the machine.**
Machine Driller	**Both**	**Operates a compressed air or electric drilling machine to drill holes into coal, rock or slate into which explosives are inserted to blast down the mass.**
Mill Labourer	**Metal**	**Performs one or a variety of routine manual duties in connection with mill operations which can be learned in a short period of time and require little or no independent judgment.**
Motorman **(Dinkey driver)**	**Both**	**Operates a small electrically or compressed-air powered dinkey engine used to haul mine cars.**
Miner	**Both**	**Performs as directed, a number of the following tasks in the extraction of ore from mines: drills blast holes, charges holes with explosives, arranges for proper guarding of all entrances to the area, fires charges; may scale loose rocks from walls or roof of working places. May carry on timbering as required. In coal mines, may not fire charges. (This is done by a certified "Shotfirer".)**

Term	Coal or Metal Mining	Description
Miner's Helper	**Both**	**Assists Miner.**
Mucker	**Both**	**Shovels excavated material into cars, or onto chutes or conveyors from which it is loaded into cars. May place cable operated scraper in loose ore and guide it to grizzly for dumping.**
Pumpman	**Both**	**Operates and maintains a power-driven pump used to pump water from underground workings.**
Rock Picker	**Coal**	**Removes rocks, slate and other impurities from the coal as it passes over the picking table.**
Sampler	**Metal**	**Collects and prepares samples of ore for assaying or mill products as directed. Keeps adequate records and makes necessary reports.**
Skip Tender	**Both**	**Loads skip with ore or rocks, operates loading passes and pockets, loading chutes and measuring pockets manually or with electrical or pneumatic devices. Communicates with Hoistman to raise or lower skips. May be required to blast hung up chutes.**
Steel Sharpener	**Both**	**Shapes, sharpens and tempers drill steel and bits.**
Screenman	**Coal**	**Operates a coal screen at the tipple.**
Solution Man	**Metal**	**Tends the operation of equipment used in the extraction of precious metal from ore in solution.**
Timberman	**Both**	**Cuts, fits and installs timbers to support walls and roof in underground workings; installs chutes, cribs, ladders and other framework; builds forms for concrete, and pours or blows concrete into place. May perform duties above ground as well.**

Term	Coal or Metal Mining	Description
Trackman	Both	Lays and repairs tracks used in underground haulageways in a mine.
Trammer	Both	Pushes loaded mine cars on tracks from workings to haulageways; pushes empty cars back to working face.
Rope Rider or Brakeman	Both	Accompanies trip of mine cars, couples and uncouples cars, throws track switches, opens and closes ventilation doors, directs movement of trips by signals to motorman.

AUDIO-VISUAL MATERIAL

Readers desiring information on film sources, available material, and the organization of local film libraries, may obtain it from the National Film Board offices listed in Monograph 1, "Carpenter", in this series.

A film strip, together with an explanatory booklet entitled *Careers in Canadian Metal Mining*, has been prepared by the Canadian Metal Mining Association for use in the schools as an additional aid in the programme of vocational guidance. Copies of this may be had by sending requests to Mr. V. C. Wansbrough, Executive Director, Canadian Metal Mining Association, Room 620, 12 Richmond Street East, Toronto, Ontario.

LOCAL INFORMATION

"CANADIAN OCCUPATIONS" SERIES

The following monographs, accompanied by pamphlets except in the cases of Nos. 13 and 20-35, have been published in this series:

(1) *"Carpenter"*

(2) *"Bricklayers and Stone Masons"*

(3) *"Plasterer"*

(4) *"Painter"*

(5) *"Plumber, Pipe Fitter and Steam Fitter"*

(6) *"Sheet-Metal Worker"*

(7) *"Electrician"*

(8) *"Machinist and Machine Operators (Metal)"*

(9) *"Printing Trades"*

(10) *"Motor Vehicle Mechanic and Repairman"*

(11) *"Optometrist"*

(12) *"Social Service Worker"*

(13) *"Lawyer"*

(14) *"Mining Occupations"*

"Careers in Natural Science and Engineering" (20-35)

(20) "Agricultural Scientist"

(21) "Architect"

(22) "Biologist"

(23) "Chemist"

(24) "Geologist"

(25) "Physicist"

(26) "Aeronautic Engineer"

(27) "Ceramic Engineer"

(28) "Chemical Engineer"

(29) "Civil Engineer"

(30) "Electrical Engineer"

(31) "Forest Engineer and Forest Scientists"

(32) "Mechanical Engineer"

(33) "Metallurgical Engineer"

(34) "Mining Engineer"

(35) "Petroleum Engineer"

DEPARTMENT OF LABOUR

Economics and Research Branch

OTTAWA, 1951

OTTAWA
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KING'S PRINTER AND CONTROLLER OF STATIONERY

CANADIAN OCCUPATIONS

★

MINING OCCUPATIONS

★

MONOGRAPH 14

REVISED 1957

DEPARTMENT OF LABOUR, CANADA

All monographs in the "Canadian Occupations" series are priced at 10 cents per copy, with the exception of *Careers in Natural Science and Engineering*, which is 25 cents. A discount of 25 per cent is allowed on quantities of 100 or more.

Send remittance by cheque or money order, made payable to the Receiver General of Canada to:

The Queen's Printer,

Ottawa, Canada.

CANADIAN OCCUPATIONS

★

MINING OCCUPATIONS

MONOGRAPH 14

REVISED 1957

HON. MICHAEL STARR, MINISTER

A. H. BROWN, DEPUTY MINISTER

DEPARTMENT OF LABOUR, CANADA

Price: 10 cents

FOREWORD

During recent years there has been a steadily increasing demand for up-to-date information on occupations.

This demand comes from youth faced with the need of choosing an occupation and of selecting the type of training required; from parents, teachers and other counsellors; from workers shifting to other occupations; from employment service officers; from directors of personnel and union officials, and from other quarters.

This series of monographs and an accompanying series of pamphlets, the latter containing similar information in a condensed form, are attempts to meet this demand. These publications are designed for general use and cover a wide range of occupations, including professions. They indicate, among other things, the nature of the occupation or group of occupations, entrance and training requirements, working conditions and opportunities in each.

The basic research and writing for this monograph was done by H. Stuart Fisher under the direction of William Allison and Phillip Cohen, all of the Occupational Analysis Section. For their assistance in preparing and validating the material, grateful acknowledgment is extended to the Department of Mines and Technical Surveys, the Canadian Metal Mining Association, the Ontario Mining Association, the International Union of Mine, Mill and Smelter Workers and the United Mine Workers of America. Acknowledgment is also extended to the Unemployment Insurance Commission and the Canadian Vocational Training Branch of the Department of Labour, Ottawa.

Acknowledgment is also made of the assistance obtained from numerous publications on occupations prepared in Canada and in other countries.

DIRECTOR,
Economics and Research Branch,
Department of Labour.

November 1957.

CONTENTS

Page

HISTORY AND IMPORTANCE 4
Canadian Geological Picture 5

TYPES OF MINES 7
Open-Pit Mines 7
Underground Mines 7
Placer Mines 9

MINING PROCESSES AND OCCUPATIONS 9
Exploration 9
Prospecting 9
Diamond Drilling 10
Assaying 11
Surveying 11
Mine Development 12
Mining (other than coal) 13
Open-Pit Mines 13
Underground Mines 14
Shaft Sinking 14
Installation of Equipment 15
Production Workers 16
Ore Treatment 18
Coal Mining 19
Strip Mines 19
Underground Mines 19
Production Workers 20
Preparation and Shipping Workers 22

QUALIFICATIONS 23

TRAINING 23

ENTRY 24

ADVANCEMENT 24

EARNINGS AND HOURS OF WORK 25

ADVANTAGES AND DISADVANTAGES 25

ORGANIZATIONS 26

TRENDS 27
Outlook 28

REFERENCES 29

APPENDIX I 31

MINING OCCUPATIONS

MONOGRAPH 14

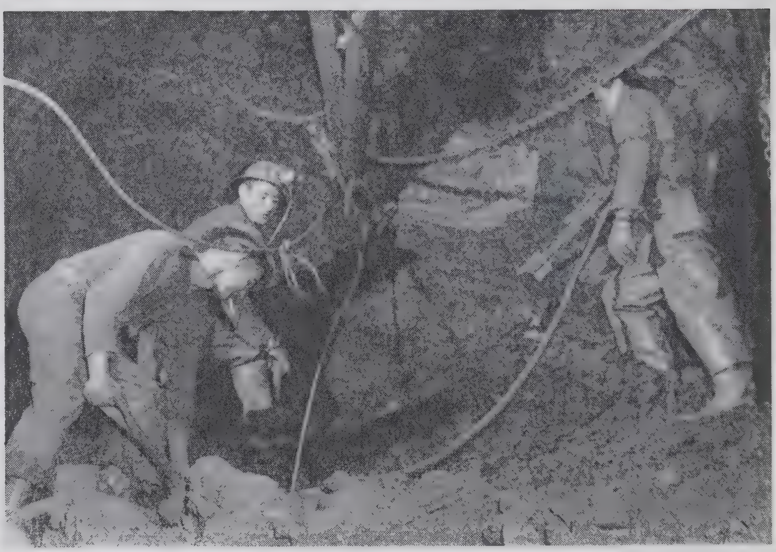


Photo: N.F.B.

Miners extract coal and other minerals from the earth's crust.

HISTORY AND IMPORTANCE

Mining is one of the oldest industries. We know that prehistoric man used primitive mining methods to obtain the flint from which he made his tools and weapons. Since then, man has learned much about minerals and has devised many ways of obtaining and using them.

Although mining operations have been carried on for centuries, most improvements in methods of locating, extracting, processing and utilizing minerals have taken place within relatively recent times. In fact, mineralogists state that we have extracted and used a greater quantity of mineral resources during the past half-century than throughout all the preceding periods of history.

Mining in Canada began in the coal seams of Cape Breton more than two hundred years ago, and systematic prospecting for minerals began about one hundred years later. The search for and development of new mining areas has been a means of extending the frontiers of our country and has turned many formerly isolated areas into thriving communities. Today, Canada is recognized as one of the foremost mining countries of the world. In 1956 the value of mineral production exceeded $2 billion.

Mining ranks with agriculture, lumber and the manufacture of pulp and paper products as a major supplier of the exports needed to enable us to buy from other countries those things that we do not or cannot produce in sufficient quantity for our domestic needs. Already the world's leading producer of nickel, platinum and asbestos, Canada ranks high on the list of suppliers of other minerals such as uranium, gold, cadmium, selenite, zinc, lead, silver, cobalt and copper.

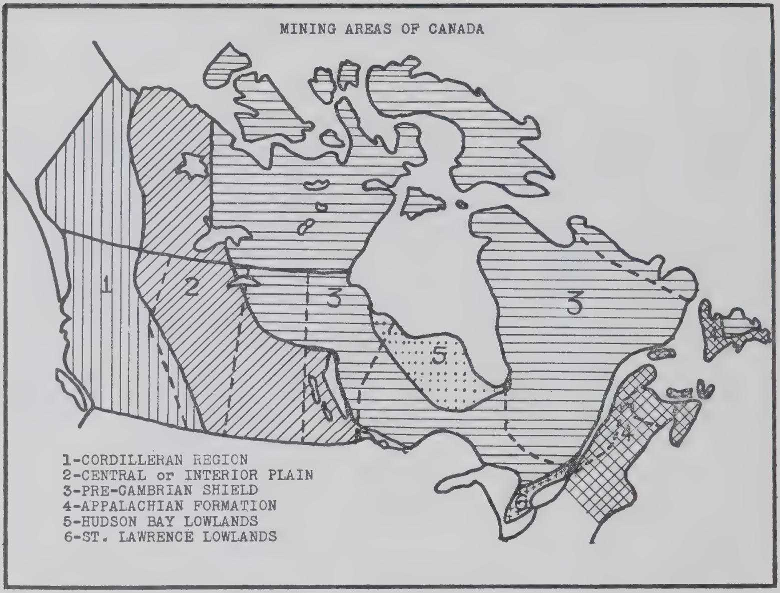
The mining industry is an important source of employment. During 1954 the total number of persons employed in the mineral industry was nearly 130,000, to whom $465 million were paid in salaries and wages.

Canadian Geological Picture

Canada is divided into six geological areas — the Appalachian, Pre-Cambrian Shield, Central Plain, Cordillera, Hudson Bay Lowlands and the St. Lawrence Lowlands. Each of these areas has definite characteristics and each contains deposits of varying importance of metallic and non-metallic minerals, as well as of fuels and structural materials.

The *Appalachian Region* of the Maritimes and Eastern Townships of Quebec is one of the principal coal mining districts of Canada and a major source of asbestos and iron ore. Important deposits of zinc and lead are being exploited in this area and there are also deposits of silver, copper, gold, gypsum, barite, salt and talc.

The *St. Lawrence Lowlands* consists of the southwest corner of Quebec and southern part of Ontario. This area provides salt, gypsum, magnesium, graphite, talc, feldspar, mica, fluorspar, oil and natural gas.



Mining areas of Canada.

The *Pre-Cambrian Shield*, sometimes called the Canadian Shield, is the largest of the regions. It includes Labrador, part of Newfoundland, most of Quebec, northwestern Ontario, the northern sections of Manitoba and Saskatchewan, and the Northwest Territories.

This is one of the world's great hard-rock mining regions. Most of the world's supply of nickel comes from a small area in the southern portion. The Pre-Cambrian is also rapidly becoming a major supplier of iron ore. Gold, silver, cobalt, platinum, lead, zinc, copper, lithium, uranium and radium are being mined at numerous locations. As a large portion of the Pre-Cambrian is as yet unexplored, it is impossible to estimate the full potential wealth of this great mining region.

The *Central Plain* lying between the Cordilleran region and the Pre-Cambrian Shield is Canada's greatest supplier of oil and natural gas. Deposits of coal, sodium sulphate, gypsum, bentonite, potash and salt are also found here.

The *Cordilleran Region*, comprising a wide strip of Southwestern Alberta, most of British Columbia and the Yukon Territory, contains a large percentage of our coal resources and is an important producer of lead and zinc. Gold, silver, oil, cadmium, asbestos, limestone and tungsten are some of the other minerals found. Canada's only placer mines are operated in this region.

The *Hudson Bay Lowlands* is a large area lying between the Pre-Cambrian Shield and the southwest coast of James Bay and Hudson Bay. Little mining exploration has been carried out in this area.

TYPES OF MINES

Factors such as location, geological formation, size, shape and depth of the deposit, and the value of the mineral contained, are all involved in the type of mine that may be developed. Underground and open-pit mining are the two principal types of operations in Canada today. The exploitation through bore holes of oil and natural gas fields, and also some of our salt deposits, is another type of mining operation, but the methods of extraction are quite different and will not be considered in this monograph.

Open-Pit Mines

An open-pit mine is a surface mine and consists of a large excavation from which the ore, exposed by the excavating process, is removed in a series of steps or benches. The asbestos mines of Asbestos, Quebec, some of the nickel mines of the Sudbury district, the iron ore mine at Marmora and the building stone and quartz quarries found in many localities are a few examples of open-pit mines.

Strip mining is a term used in the coal mining industry and refers to the recovery of coal from surface beds using methods similar to those used in an open-pit mine.

Although open-pit mining is relatively simple, compared with underground operations, it is economically feasible to a limited depth only. After that it becomes necessary to convert to underground methods.

Underground Mines

An underground mine usually consists of a main vertical shaft in or close to the ore body. From this shaft connecting roadways

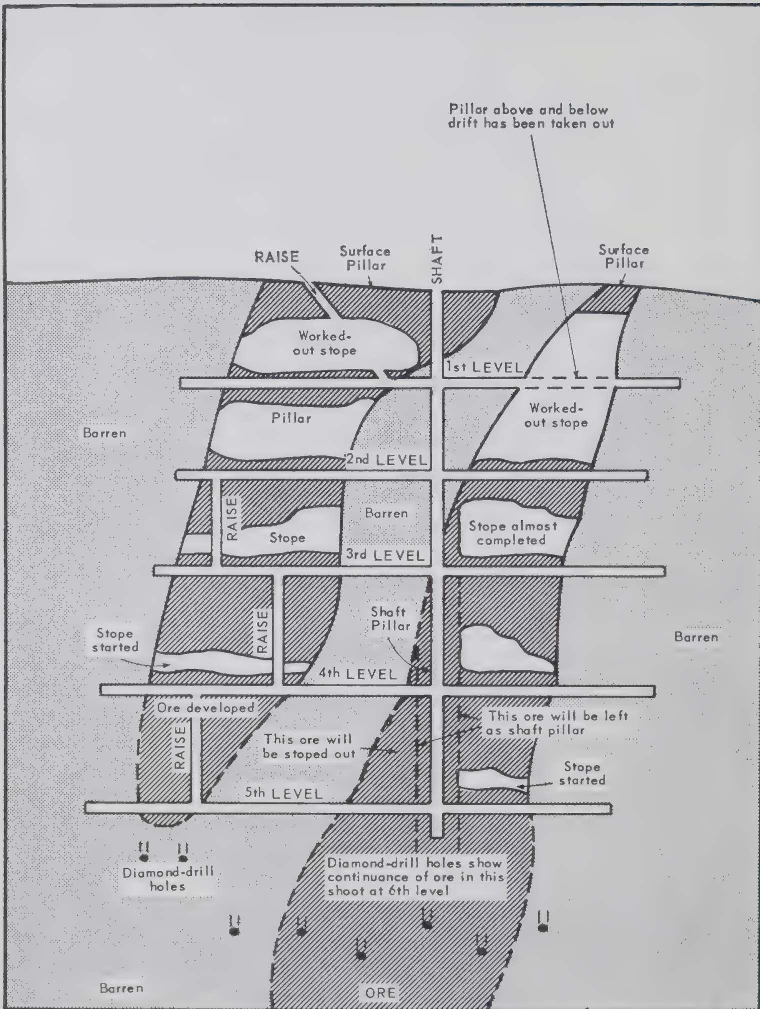


Diagram: Dept. of Mines & Technical Surveys

Longitudinal section illustrates the history of a mine: worked out stopes on upper levels, active stopes beneath, and ore being developed in lower levels.

called "crosscuts" are then driven through rock to the deposit at regular intervals. Excavations within the deposit from which ore is being removed are called "stopes" and the passageways that follow the ore-vein are called "drifts".

Where the deposit is located near the side of a hill, access to the ore is sometimes gained by means of a horizontal tunnel or adit driven directly into the hillside.

Placer Mines

Placer deposits are the result of the sorting action of waves or flowing water on mineral-bearing rock. The rock material is gradually washed away, leaving the heavier mineral to settle in a sheltered area out of the main current. Placer deposits are often discovered high in the bank of a stream and also in areas that were formerly stream beds. The minerals usually found in placer deposits are gold, tin, tungsten and platinum.

Few placer mines are operated in Canada now, the only ones of value being those of the Yukon and the northern sections of British Columbia.

MINING PROCESSES AND OCCUPATIONS

EXPLORATION

Prospecting

The search for valuable minerals forms an exciting chapter in our history and has been an important factor in opening up the Canadian hinterland. Not many years ago, anyone with an elementary knowledge of minerals, a pick and shovel, and a willingness to endure a solitary life in the out-of-doors could become a prospector. Today, prospecting is a highly skilled occupation and the *prospector*, using a variety of scientific equipment, usually works as part of a team. Some prospectors are graduate geologists.

The modern prospector may obtain considerable advance information about the area in which he intends to search. Information is derived from charts and photographs obtained from government surveys made with aerial cameras and magnetometers, as well as from maps compiled by ground survey parties.

Photo: N.F.B.

The prospector uses a variety of scientific equipment.

The use of modern equipment such as the geiger counter to locate radioactive minerals, the battery-powered ultra-violet lamp to reveal colour trace, and small portable diamond drills for exploratory boring, has greatly assisted the prospector in his search for valuable minerals.

When he finds signs of a promising geological formation, the prospector stakes the area and proceeds to "prove" his find. "Grab" samples of ore are sent to the assayer for analysis for mineral content.

Diamond Drilling

If initial tests are promising, *diamond drillers* continue the work of the prospector. They seek to outline the size and shape of the deposit and determine its value by obtaining ore samples from as much as four or five thousand feet below the surface.

The diamond drill uses hollow rotary drill rods with a diamond-studded cutting ring at the forward end of the rod. The cylindrical piece of rock or "core", that is cut by the diamond ring, is retained within a special core barrel and brought to the surface. It is then examined by the geologist, labelled as to the location, depth and angle from which it was obtained, and sent to the assay office for analysis. In some cases, the cores are stockpiled for future reference.

Diamond drilling does not cease with the discovery of a mineral deposit. After the mine has been established the diamond driller continues to probe the deposit. Working from an underground level of the mine, he seeks out the continuation of the mineral and the direction in which it lies.

Assaying

The *assayer* crushes and pulverizes the ore samples to the required fineness and then makes a chemical analysis to determine the value of the mineral content. The results of his findings are important in determining whether the deposit can be developed into an economical mining operation.

When the mine is in operation the assayer checks the value of mine production by analysing samples of the ore being removed. The *sampler* collects the required samples from various parts of the mine. Using mechanical or hand tools he drills, cuts, grooves, channels or chips small pieces off the working faces or selects samples from conveyors, bins or cars. He bags the samples, labels them and keeps records of where they were obtained. He may plot on a map the location of samples taken.

Surveying

The *mine surveyor* surveys the mine area and marks on maps the location of all water courses, roads, outcrops of mineral deposit, variances in ground elevation and any other important physical features. As development progresses the surveyor keeps the maps up to date and indicates any changes. The mine surveyor also makes accurate drawings of all underground workings, showing main and secondary shafts, drifts, crosscuts, worked-out areas, abandoned stopes, tunnels and shafts, as well as the location of veins of ore. These drawings aid in maintaining safe working conditions and also in plotting the course of future tunnels and shafts.

Photo: N.F.B.

Assaying ore samples.

MINE DEVELOPMENT

The development of a new mine is a specialized construction job, designed to set the stage for the systematic extraction and processing of ore. As many new mines are located in remote areas, it is usually necessary to construct a road or even a railway to provide a means of getting men, equipment and supplies to the area and later, the mineral to the consumer. In very remote regions, air transportation is required, with landing strips constructed in clearings or on frozen lakes.

Surface buildings for milling the ore, storing supplies, housing equipment, workshops and power houses, as well as living quarters for the workers must be erected. Eventually, if the mine develops satisfactorily, the mining camp must be enlarged to include homes for the workers' families, schools, recreation centres and all the

facilities necessary for a community. It is therefore apparent that a successful new mining venture gives rise to employment opportunities for many people not directly connected with mining.

MINING (OTHER THAN COAL)

Open-Pit Mines

The first operation necessary in open-pit mining is the removal of the overburden covering the deposit, the thickness of which may vary from a few feet of loose soil to several hundred feet of hard rock. This operation is done by operators of huge earth-moving equipment such as draglines and bulldozers. In the case of a hard rock overburden it would first require blasting.

The ore that has been exposed is then mined out in a series of steps. Although the usual practice is to work down from the surface or into the side of a hill, some open-pit mines, such as the one at Steep Rock, have been formed by draining and dredging a lake in order to expose the ore.

After the overburden has been removed, *drillers*, skilled in the use of rotary or percussion type drills, bore a series of holes into the exposed face of the ore. A long section of the face is usually drilled at the same time by a battery of drills under the supervision of an experienced driller called the *drill foreman* or *shift boss*. The blast holes are charged by the *blaster* (in some cases by the driller) with the proper amount of explosive necessary to break down the desired section of wall. The *pit foreman*, who is in charge of all phases of open-pit mining, detonates the charges.

Before work resumes, *scalers* inspect the faces and pry free any loose rock that may fall on those who will be working below.

Ore dislodged by the blast in boulders too large to be picked up by power shovels is broken into smaller pieces by drillers using pneumatic drills. Often, instead of drilling, this secondary breakage is done by *crane operators* who operate cranes to raise a heavy weight called a "drop ball" and drop it on the boulders.

After that the loose ore is loaded into heavy trucks by mechanical shovels under the control of *power-shovel operators*. *Truck drivers* haul the ore out of the pit and deliver it to the ore crusher where it is prepared for further treatment in mill or smelter.

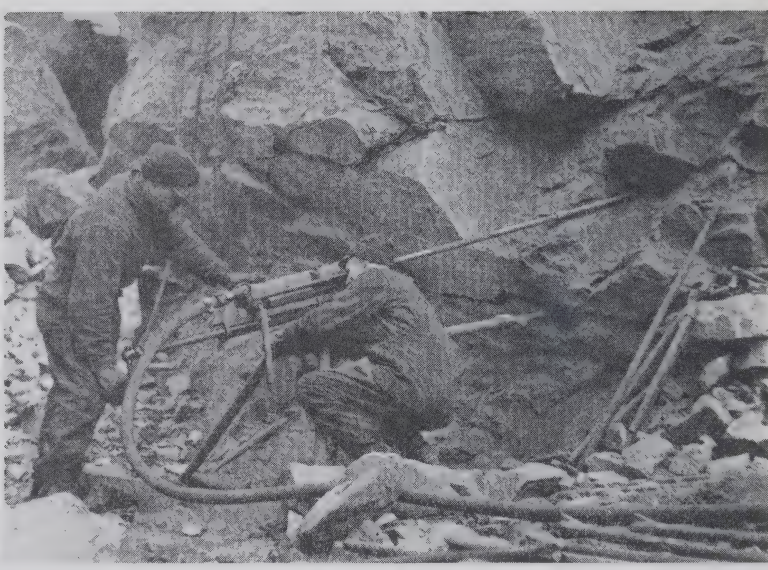


Photo: N.F.B.

Drilling blast holes in an open-pit mine.

Most of the skilled workers in an open-pit mine have *helpers* who assist them while learning the skills of the job.

Underground Mines

The underground development of a mine is a most complex and expensive operation. It includes shaft sinking, drifting (tunnelling), and the installation of surface and underground systems of transportation, ventilation, power (compressed air and electric), water supply and drainage.

The *mine manager*, usually a graduate mining engineer, is responsible for all phases of mine development, production and production control. He is assisted by a *mine superintendent* and a *mill superintendent* who are also usually mining engineers.

Shaft Sinking

The shafts are usually sunk by crews of experienced miners (*shaftmen*) who specialize in this work. These workers drill, blast

and muck out the floor of the shaft. As the shaft is deepened, the walls are timbered and, at regular intervals — usually 100 to 200 feet — enlarged areas called "stations" are cut out and "levels" established.

"Cross-cuts" are driven through the barren rock from the shaft stations to the ore body and then "drifts" are made along the ore vein. In driving these subterranean passageways, skilled *drill crews* bore holes in the face of the tunnel and then install and set off charges of explosives. *Scalers* then "bar" down any loose rock from the walls and roof. The broken rock is mucked out by crews of *muckers* and hoisted to the surface.

Installation of Equipment

As development of the mine proceeds, certain machinery and equipment is necessary for the safety and operation of the mine.

Skilled *mechanics* install hoisting equipment at the top of the shaft for conveying men, material and ore. *Timbermen*, usually experienced miners with carpentry skill, cut, fit and install timbers in the passageways of the mine to support the walls and roof. In some cases, they may use rock bolts or steel beams and braces, instead of timbers. They also build the chutes, cribs, ladders and other frameworks needed in the mine.

Water occurs frequently in many mines and *pumpmen* are needed to operate power-driven pumps that evacuate the water in underground workings.

Trackmen lay and maintain the system of tracks needed in underground haulageways for mine trains. Conveyor belt systems and trackless mining equipment are supplanting mine cars in conveying ore and coal out of some mines.

Most of the mines in operation today are illuminated by electric lights and much of the equipment used is powered by electricity. *Electricians*, trained through apprenticeship, install and maintain electrical mine equipment.

Steam, electric or gasoline-powered air compressors, operated by *compressormen*, supply the compressed air necessary for the operation of drills and other pneumatic equipment. *Pipe fitters* install and maintain the system of compressed-air pipes and water pipes leading to the working areas of the mine.

A good ventilating system is an extremely important factor in keeping the working conditions of a mine as safe and healthy as possible. *Fan men* supervise the operation of large mine fans which send huge volumes of fresh air coursing through the mine workings.

Mine mechanics take care of the general maintenance and repair of machinery and mechanical equipment used in the mine. They oil, grease and clean the equipment, examine it for defects in operation and replace worn or broken parts. While primarily concerned with repair work, they may also work on the installation of machinery.

In addition to the occupations already referred to, other workmen are necessary in the development of a mine as well as in its maintenance and operation. As most of these other occupations are common to several industries, only brief mention will be made of them here. *Tool and steel sharpeners* shape, sharpen and temper drill steel and bits. *Machinists* make new and replacement parts for mechanical equipment used in the mine. *Blacksmiths* forge metal parts necessary for the repair of machines and other equipment. *Diesel mechanics* service and repair diesel engines used in and about the mine. *Welders* fabricate metal parts and also repair cracked or broken pieces of equipment. Tradesmen's helpers keep the tradesmen supplied with tools and materials and clean the work area, machines and equipment. The helpers may also be required to perform routine machine operations such as feeding or unloading a machine and holding tools or equipment.

Production Workers

Miner is a general term used to designate the group of workers who carry out the complete set of duties required to extract coal, ore, rock or waste material and transport it to the surface. Miners are usually known by the machines or equipment they operate (driller, mucking-machine operator) or the work they do (blaster, mucker).

The *driller* works at the extraction face and employs a pneumatic drill to bore a pattern of holes into the ore body. These holes are then charged with explosives by the *blaster* and wired or fused so as to explode in a pre-determined order. The miners then make arrangements for the safeguarding of all entrances to the area and when all is clear, the charges are set off.

Photo: N.F.B.

Working at a chute—note safety precautions.

Ore that has been broken down by drilling and blasting is moved out of the stope by the *mucker* who shovels it either directly into mine cars, or onto conveyors or into chutes from which cars will be loaded. The mucker may operate a mechanical scraper or "slusher" to drag the loose ore to the ore chute. In some mines, a *mucking-machine operator* sets up and operates a mechanical shovel or scraper-type loader. This machine scoops up the ore and loads it into mine cars, ore chutes, or onto a conveyor belt.

Usually ore cars are loaded from a chute that connects the stope area to the haulageway below. It is the duty of the *chute blaster* to keep the ore flowing freely. The flow of ore out of the chute is controlled by a loading gate. Should the chute become clogged the chute blaster starts the ore flowing again. If the chute is "hung-up" (clogged to such an extent that it cannot be loosened

by barring or jammed by a too large piece of rock) he may have to drill or blast it to start the ore flowing again. The chute blaster is also responsible for directing and assisting underground labourers in loading the ore cars and assembling them into trains.

Trammers push loaded ore cars along the passages to the main haulageways and empty ones back to the ore chutes. They may also load or unload the ore cars.

Small locomotives, operated by *motormen*, haul the trains of ore cars to the shaft stations. Riding along with or walking ahead of the trains are *switchmen* or *rope riders* who couple and uncouple the cars, throw the track switches and direct the movements of the trains by signalling the motormen. At the shaft station the loaded mine cars are either placed in the cage to be hoisted to the surface or emptied into a loading pocket.

The *skip tender* loads the skips with ore. He controls the flow of ore through the ore chute from the loading pocket by operating a loading gate. He inspects the loaded skips and signals the hoistman to raise or lower them. The skip tender may also be required to take charge of other shaft conveyances and ring signals for the raising and lowering of men and equipment.

The work of the *cage tender* is similar to that of the skip tender. He communicates with the hoistman to control the movements of the cage. He may move loaded or empty cars on or off the cage or ride the cage and assist with the loading and unloading at all levels. Occasionally the cage tender performs the duties of the skip tender.

The loading and unloading of the deck or platform of the cage with ore cars, equipment and supplies, at the surface as well as at various shaft stations, is done by the *deckman*.

The responsibility for the safe movement of all shaft conveyances rests largely with the *hoistman*. Upon receiving signals from the cage or skip tenders or deckman, he operates hoisting equipment to raise or lower the skips and cages. The hoistman also inspects his machinery and reports the need for any repairs necessary to keep the hoist operating safely.

Ore Treatment

Since minerals are seldom mined in a pure state, they must be separated from the worthless rock. As a rule, the ore as mined must first be crushed before further processing can proceed.

Although some of the larger mines do preliminary crushing work underground, most mines send the ore directly to a surface mill. At the mill the ore is fed into huge crushing machines controlled by *crusher operators*. The crushers break the ore up into pieces of about the size of gravel. It is then further reduced to the desired size by *grinding-mill operators* who are in charge of ball or rod grinding machines that pulverize the ore in water. The soupy solution that results is now ready for further treatment.

The extraction method used depends on the nature of the mineral being extracted and the other substances present in the solution. *Solution men* operate equipment used in extracting precious metals from ore in solution. In many cases, separation of mineral from mineral, and mineral from waste, is done in a series of flotation cells operated by a *flotation operator*. After the minerals have been separated, water is removed from the concentrates by drum filters controlled by *filter operators*.

COAL MINING

In contrast to the irregular formation of ore veins, coal seams generally occur as somewhat regular layers, either horizontally or inclined, and range in thickness from a few inches to many feet. A significant difference between coal and metal mining is the presence of certain hazards, such as explosive gases and dust, and the higher degree of roof control required in coal mines.

Strip Mines

Strip mining, which is quite similar to the open-pit mining of ores, is a method used when a coal deposit of substantial value lies close enough to the surface to warrant uncovering it and mining it from the surface.

Underground Mines

The terms "shaft" mine, "slope" mine and "drift" mine designate the type of principal access to the coal seam. Access to the seam is gained by means of a vertical shaft in a shaft mine and through a sloping tunnel in a slope mine. In a drift mine, the main entry is a horizontal tunnel driven into the side of a hill or mountain. The two methods most commonly used in extracting coal in underground mines are "room and pillar" mining (where

pillars of coal are left standing to support the roof of the mine and, quite often, removed later) and "long wall" mining (where the seam is completely extracted in one operation and the roof rock is allowed to collapse).

Production Workers

Although many of the underground mining occupations that have been described for metal mines are also required in coal mining, they may be referred to by different names and, in addition, certain jobs are peculiar to coal mining alone.

The *fire boss*, like a shift boss in a metal mine, is in charge of a section of a mine and is responsible for production and the safety of all the men working in that section. Before any work begins he examines the section with a flame safety lamp to determine whether or not there is any dangerous accumulation of explosive mine gases. He visually inspects the working faces and roadways for excessive accumulations of coal dust, which is also highly explosive. He also ensures that all passageways are kept clear, that loose rock is removed from walls and roofs, that the working faces are adequately timbered and that proper ventilation is carried out.

In coal mines explosives are set off only by a fire boss (in some mines known as a "shot firer"). When blasting has been completed the fire boss re-examines the working faces to ensure that no fires have broken out, that the explosives have satisfactorily broken the coal and that timbering and ventilation are adequate.

Owing to the presence of explosive gases ventilation is a particularly important factor in coal mining. The *bratticeman* helps in the control of ventilation by hanging canvas curtains to guide the air along underground passages. He also uses materials such as wood, brick or concrete to build partitions of a more permanent nature for the same purpose.

To facilitate the movement of men, equipment and cars of coal from one section of the mine to another, all passageways must be made of adequate size and kept as clear as possible. The *brusher* is responsible for enlarging the passageways, particularly in thin seams, by drilling, blasting and removing rock from roof or floor until a desired height is attained. Generally, he is also required to install heavy, permanent roof supports such as steel arches or heavy steel rails.

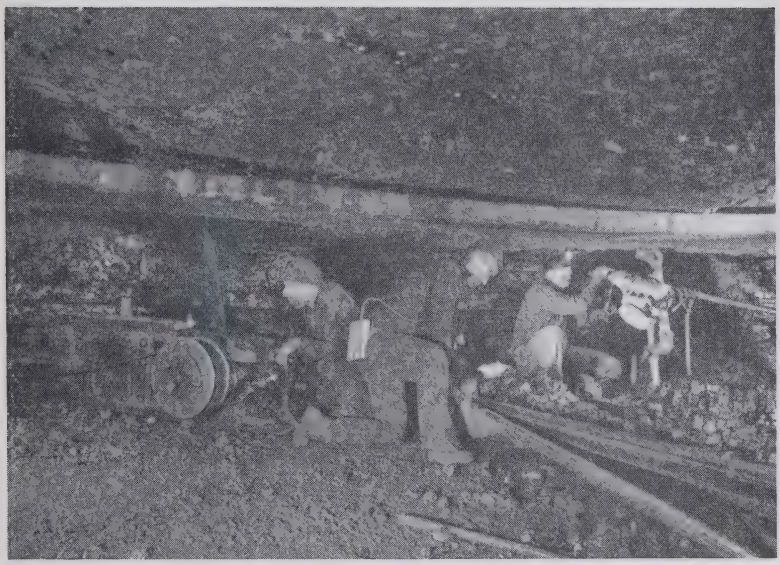


Photo: N.F.B.

The modern coal miner has become a skilled machine operator.

The men who actually extract the coal in Canadian mines are divided into two classifications — *contract miners* and *datal miners*. Both perform essentially the same functions, that of cutting, boring and loading the coal in addition to erecting such timbering as is required to make the working place safe. The contract miner, however, is paid on a tonnage or "piece work" basis and the rates for such work are established by a contract agreement between men and employer. The datal miner is paid a fixed wage per day.

There has been a trend toward more mechanization at the coal face. Mechanical cutters and boring machines have long been employed and, at present, mechanical loaders are rapidly replacing the traditional shovel. The modern coal miner has become a skilled machine operator. The *machine cutter* operates a coal cutting machine that makes a horizontal or vertical slot in the coal face to a depth of 4 to 9 feet, thus enabling the subsequent blasting to break down the coal without pulverizing it. The *coal borer* uses light, efficient drills to bore the cut face for insertion of explosives.

The *machine loader* operates a machine to load the loosened coal into mine cars or onto conveyor systems. He drives the machine to the working area, makes the proper power connections, braces the machine and starts the loading mechanism. As the coal is loaded he advances the machine along the working face.

Continuous mining machines are a further advance in mechanization, for they eliminate the separate operations of cutting, boring, blasting and loading. This type of machine is set up at the working face and, as it advances, it digs the coal free from the solid seam and loads it onto a conveyor belt or into mine cars all in one continuous operation.

Timbering machines have also been devised to lighten the manual effort of erecting heavy supports, and roof bolting machines are employed to facilitate the use of this relatively new method of holding up mine roofs.

Despite the advances made in mechanizing operations much manual labour must still be performed, particularly in steeply pitching seams where it is difficult or impossible to operate and manoeuvre large track-mounted or crawler-mounted machines. Even in flat lying coal seams certain operations are impractical or impossible to mechanize. In moderately pitching seams it is necessary to employ *buckers* to keep the coal moving down inclined chutes from the coal face to the mine cars on the haulage levels. In all seams it is necessary for a substantial force of *material handlers* to distribute timber, drill steel, explosives, etc. from the surface supply yard to the underground working faces.

Preparation and Shipping Workers

When the coal is hoisted to the surface, it is weighed by a *weighman*, and then passed on to picking belts where large pieces of stone are removed by *rock pickers*. If large lumps of coal are present, it is then fed to a breaking machine and passed over a series of shaker screens operated by *screenmen*. These screens separate the coal into the different sizes demanded by the market. If considerable impurities remain in these sizes, such coal is fed to a cleaning plant where they are mechanically removed under the supervision of a *cleaning-plant operator*. *Car loaders*, using mechanical shovels or coal chutes, load the coal into boxcars or gondolas to be transported to market.

QUALIFICATIONS

The minimum age limits for employment in and around a mine are governed by provincial law and may vary from province to province. It is a general rule that no person under 18 years of age will be permitted to work underground.

A miner must have a strong physique and be free from serious physical handicap, especially respiratory disability. Mining regulations require that all employees who work underground, and in some cases certain surface workers, must pass a physical examination.

Working underground, in close quarters and in areas of potential danger, calls for nerve, resourcefulness and the ability to think clearly and to act quickly in an emergency. Many miners have demonstrated great bravery in the face of disaster.

There is no specified standard of education required for employment in a mine, and it is possible for persons with limited education to earn good wages. However, the person with a good formal education has a better chance of getting ahead. In most mines, some knowledge of English or French is desired to enable the worker to understand routine instructions and to abide by the safety regulations which are posted at strategic places in or about the mine.

Because he must work as part of a team and must realize the importance of complying with regulations governing the safety of the mine, a good sense of co-operation and responsibility are desirable qualities in a miner.

Mine officials and certain classes of miners must obtain Certificates of Competency through examination by provincial Departments of Mines. Requirements for employment in open-pit mines may not be as strict as those in underground mines.

TRAINING

Miners are usually trained on the job. In some of the larger mines, training classes are conducted in a special section of the mine known as the "training level" or "school stope". This period of practical training enables the beginner to become familiar with the nature of the work, the various tools and equipment and the different methods used. He also becomes acquainted with the precautions and regulations necessary for mine safety.

Preliminary training may be obtained at the Lakehead Technical Institute in Port Arthur, and the Provincial Institute of Mining at Haileybury. Each offers a two-year course in technical mining for those who have obtained the Ontario Secondary School Graduation Diploma or equivalent. Some of the subjects taught are prospecting, mineralogy, geology, geological mapping, metallurgy, surveying, milling, mine ventilation, mine safety, mining methods, machinery, and law and management. Full details regarding prerequisites and enrollment may be obtained from the Principal, Provincial Institute of Mining, Haileybury, Ontario, and the Principal, Lakehead Technical Institute, Port Arthur, Ontario.

ENTRY

Those seeking employment in mines should first of all apply to a National Employment Service office in order to become acquainted with local, regional or national employment possibilities. This will minimize time-consuming and expensive door-to-door job seeking. Applications are also accepted directly at the offices of mines, mills and smelters; many large firms have employment officers who look after such applications. General information on employment prospects may also be obtained from provincial Departments of Mines.

Those who graduate from university or technical mining schools will generally find their services being sought after and should have ample opportunity to establish contact with employers.

ADVANCEMENT

There are few positions closed to a competent and ambitious man. Underground workers usually begin as mine labourers, trammers or muckers. As they become familiar with mining procedures they generally become mine helpers and, after acquiring the necessary knowledge and ability, advance to the skilled work of equipment operators, timbermen, blasters, etc. Skilled workers having the required experience and personal qualifications can become foremen or shift bosses. A foreman may in turn be advanced to the more responsible position of mine captain or, in coal mines, underground manager.

Surface workers may become foremen.

The advancement of mill workers ranges from labourer to helper and then to one of the skilled jobs such as crusherman,

filter operator or solution man. Foremen are promoted from the ranks of the skilled workers and may be further advanced to the position of mill superintendent, although advancement to this level is less frequent.

Workers employed in open-pit mines may expect a similar range of promotions. Starting as labourers they may advance to the position of helper and then to driller or machine operator. Experienced drillers may become drill foremen and then shift bosses and eventually pit foremen.

EARNINGS AND HOURS OF WORK

Miners' wages vary considerably according to the location of the mine, the specific work performed and the demand for the mineral being mined.

Increases in average hourly earnings over the past few years have been more substantial in some divisions of mining than in others. During the period 1945-1956, average hourly earnings in coal mining increased from 93 cents to \$1.49 and in metal mining from 85 cents to \$1.78. Average hourly earnings in non-metal mining increased from \$1.16 in 1951 to \$1.58 in 1956. The annual average hourly earnings of wage earners for the mining industry as a whole have increased from 85 cents in 1945 to \$1.71 in 1956.

Men employed underground are normally on a production bonus in addition to a cost-of-living bonus and basic pay. Mine workers may be paid by the day, the week, the month or by contract — basic rates guaranteed in the event of any contract.

In Appendix I, tables taken from *Wage Rates and Hours of Labour — 1956* show standard hours per week and the average hourly earnings for selected hourly-rated mine workers.

ADVANTAGES AND DISADVANTAGES

The mining industry provides an excellent field of work for persons of limited education. Earnings are higher than those of other industries having similar educational and training requirements and there are many opportunities for advancement. Furthermore, the average mine beginner is promoted to mine helper and finally to miner in a relatively short period of time.

Canadian miners are well organized. In recent years, the the welfare of the miner has been given much consideration by

employers and unions alike, with the result that there has been a trend toward providing holidays with pay, hospitalization and medical insurance. In the event of injury while working, or unemployment, miners may receive benefits under workmen's compensation or unemployment insurance.

In most cases miners are assured of regular employment, particularly in metal mines that are not affected by seasonal variations. On the other hand, fluctuating markets for coal and some building materials may result in slack periods. Employment depends, of course, on continued mine operation. Prior to the exhaustion of a mine, operations are usually started elsewhere, provided this is possible and economically worthwhile.

The discomforts of dirt, dampness and water have been reduced by the wearing of special clothing, the use of pumps for drainage, and the installation of ventilating systems to supply fresh air at a comfortable temperature.

The possible dangers of falling rock, cave-ins and other hazards associated with mining are factors to consider. Mine safety regulations and precautions are well developed, however, and preventable accidents are kept to a minimum. The majority of Canadian mines have a specially trained "safety engineer", whose primary job is to enforce the regulations as laid down.

Living costs are sometimes high in remote mining towns because construction costs exceed those in most other localities. Local supplies of food products are sometimes scarce, and the supply centres for all goods may be distant. In many instances, however, low-rent company houses are available to married workers, single employees are boarded at reasonable rates, and company stores supply many of the essentials at favourable prices.

ORGANIZATIONS

There are at least 70,000 union members in the Canadian mining industry. The union concerned with the mining of coal in Canada is the United Mine Workers of America. The International Union of Mine, Mill and Smelter Workers and the United Steelworkers of America are the two organizations largely responsible for the organizing of workers in the metal mining industry of Canada. The National Federation of Mining Industry Employees, Inc., an affiliate of the Canadian and Catholic Confederation of Labour, draws its membership from the mines of Quebec, particularly the

asbestos mines. Other unions are active throughout the industry on a local basis.

TRENDS

The general trend toward expansion and increased production apparent in the Canadian mining industry over the past few years is expected to continue.

The present development of new mines and the continuing high rate of production of established ones are indications that the crest of mineral production in Canada has not yet been reached. Only a fraction of the country has been mapped for geological purposes and as this work proceeds it is likely that many new deposits will be discovered.

Recent developments of importance include the mining of uranium at Beaver Lodge and Blind River, iron ore at Steep Rock and the New Quebec-Labrador area, copper in the Gaspé peninsula and the expansion of asbestos mining in the Eastern Townships, to name only a few. It is expected that the establishment of productive mines in Northern Manitoba, involving the

Photo: N.F.B.

A mechanical shovel loading mine cars.

building of a railroad spur line and a townsite to accommodate about 8,000 people, will substantially increase Canada's annual nickel output.

Increases in the number of prospecting parties at work in the field and the large number of new claims that are being staked in several different regions can be looked upon as indications of probable future expansion in the industry. In addition to increased activity in new areas, there has also been an expansion in the amount of prospecting that is being carried on in areas that have been previously worked over. This latter fact can be attributed to the perfection and greater use of specialized prospecting equipment and the development of more economical ways of recovering and processing low-grade deposits.

Research work carried on by mining and smelting companies has resulted in the development of processes which provide a greater utilization of certain elements contained in the ore. These elements were formerly considered to be unavoidable nuisances associated with the refining operations, and as such, were discarded. Typical of these new processes is the recovery of sulphur dioxide from smelter stacks. The retention of such by-products has frequently resulted in improved economic operation of the companies, reduced the quantity of waste material and prolonged the productive life of the mine.

The competition from oil and natural gas has been sufficient to affect seriously the consumption of Canadian-produced coal. In order to reverse this trend, investigations are being conducted to find new uses for coal and to improve the by-products. The fact remains, however, that the number of operating coal mines in Canada has decreased every year since 1939. The same downward trend has been evident in total coal production and in the number of persons employed in coal mining. It is evident that mechanization of coal mines in the Maritimes and Western Canada must be progressive if the industry is to continue as a substantial employer. Such trends and needs also indicate that the miner of the future will be a skilled machine operator.

Outlook

All indications point toward a bright future for the Canadian mining industry, especially in the metallic and industrial minerals and petroleum. It can be expected that, as the standard of living in North America and the rest of the world is raised, the expansion

Photo: N.F.B.

. . . satisfaction in good fellowship and teamwork.

of the Canadian mining industry will continue. Physical volume of mineral production has more than doubled since the period 1935-39; in dollar value it has increased four-fold. It is expected that the total value of the industry's production by 1980 may be 3½ times present levels.

There are few industries that offer as many opportunities for mentally and physically suitable young men to obtain the status and pay of a skilled worker in a short time. There are many opportunities also for professionally trained men, technicians and skilled tradesmen in exploration work, technical mining operations and supervisory positions. The work is hard and sometimes dangerous, but there is satisfaction in good fellowship and teamwork and in doing a job essential to Canada's prosperity.

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For general current information on hard-rock mining, the *Northern Miner*, weekly, Toronto, is useful to indicate developing trends. Financial publications and the financial columns of the daily press may be followed to note the expansion or contraction of various mining areas. Feature articles appearing in magazines and week-end supplements of Canadian newspapers often give interesting accounts of the Canadian mining scene.

Western Miner and Oil Review (monthly) Vancouver, B.C.

The *Western Canada Coal Review* for April, 1957, carries an interesting article on the operation of a modern coal mine.

AUDIO-VISUAL MATERIAL

A filmstrip, together with an explanatory booklet entitled *Careers in Canadian Metal Mining* has been prepared by the Canadian Metal Mining Association for use in schools as an additional aid in the program of vocational guidance. Copies of this may be had by sending a request to Mr. V. C. Wansbrough, Executive Director, Canadian Metal Mining Association, Room 335, 12 Richmond St. East, Toronto, Ontario.

The National Film Board of Canada has produced a 53-frame filmstrip entitled *Mining Occupations* for the Economics and Research Branch of the Department of Labour, Ottawa. The filmstrip is based on, and supplements, monograph No. 14 of the "Canadian Occupations" series. It is available through the National Film Board of Canada, Box 6100, Montreal, Quebec.

APPENDIX I

The following tables are taken from the Department of Labour publication *Wage Rates and Hours of Labour*, 1956.

Underground workers in mining frequently receive incentive bonus payments in addition to the rates shown.

STANDARD HOURS AND WAGE RATES FOR SELECTED MINE WORKERS 1956

GOLD MINING[1]

Occupation and Locality	Wage Rate per Hour	
	Average	Predominant Range
	$	$
Standard Hours per Week: Predominantly 44 in Quebec, Ontario, and British Columbia.		
Underground Workers		
Cage and Skip Tender		
Canada	1.37	....
Quebec	1.35	1.25—1.44
Ontario	1.36	1.25—1.45
British Columbia	1.51	1.50—1.54
Chute Blaster		
Canada	1.32	....
Quebec	1.28	1.05—1.36
Ontario	1.34	1.32—1.44
Deckman		
Canada	1.28	....
Quebec	1.24	1.20—1.36
Ontario	1.29	1.21—1.39

[1] Does not include alluvial gold mining or copper-gold-silver mining.

Occupation and Locality	Wage Rate per Hour	
	Average	Predominant Range
	$	$
Hoistman		
Canada	1.46	....
Quebec	1.40	1.25—1.49
Ontario	1.46	1.38—1.53
British Columbia	1.69	1.58—1.73
Labourer		
Canada	1.27	....
Quebec	1.19	1.12—1.36
Ontario	1.31	1.20—1.35
Miner		
Canada	1.36	....
Quebec	1.31	1.22—1.36
Ontario	1.36	1.29—1.50
Britis hColumbia	1.56	....
Miner's Helper		
Canada	1.26	....
Quebec	1.21	1.15—1.25
Ontario	1.27	1.21—1.45
Motorman (Motor Operator)		
Canada	1.33	....
Quebec	1.29	1.17—1.36
Ontario	1.32	1.25—1.39
British Columbia	1.46	1.45—1.50
Mucking-Machine Operator		
Canada	1.32	....
Quebec	1.29	1.25—1.31
Ontario	1.32	1.25—1.44
British Columbia	1.55	....

Occupation and Locality	Wage Rate per Hour	
	Average	Predominant Range
	$	$
Mucker and Trammer (Shoveller)		
Canada	1.25	....
Quebec	1.25	1.15—1.28
Ontario	1.20	1.12—1.26
British Columbia	1.39	1.36—1.42
Pipefitter		
Canada	1.40	....
Quebec	1.37	1.30—1.42
Ontario	1.40	1.32—1.55
British Columbia	1.56	1.50—1.63
Timberman (Shaft Timberman)		
Canada	1.38	....
Quebec	1.34	1.22—1.39
Ontario	1.37	1.27—1.58
British Columbia	1.64	1.54—1.69
Trackman		
Canada	1.35	....
Quebec	1.33	1.25—1.37
Ontario	1.35	1.28—1.47
Surface and Mill Workers		
Carpenter		
Canada	1.45	....
Quebec	1.34	1.22—1.52
Ontario	1.49	1.39—1.58
British Columbia	1.63	1.45—1.73
Crusher Operator (Crusherman)		
Canada	1.32	....
Quebec	1.29	1.10—1.36
Ontario	1.32	1.23—1.43
British Columbia	1.47	1.45—1.54

Occupation and Locality	Wage Rate per Hour	
	Average	Predominant Range
	$	$
Electrician		
Canada	1.50	....
Quebec	1.45	1.28—1.53
Ontario	1.52	1.40—1.68
British Columbia	1.67	1.54—1.73
Labourer		
Canada	1.19	....
Quebec	1.14	1.00—1.25
Ontario	1.20	1.14—1.32
British Columbia	1.31	1.24—1.38
Machinist		
Canada	1.47	....
Quebec	1.41	1.25—1.52
Ontario	1.49	1.42—1.55
Maintenance Mechanic		
Canada	1.46	....
Quebec	1.41	1.31—1.52
Ontario	1.45	1.32—1.62
British Columbia	1.63	1.54—1.69
Millman[2]		
Canada	1.37	....
Quebec	1.33	1.20—1.47
Ontario	1.37	1.26—1.49
British Columbia	1.52	1.45—1.73
Steel Sharpener (Bit Grinder; Bit Sharpener)		
Canada	1.37	....
Quebec	1.33	1.25—1.52
Ontario	1.37	1.31—1.44

[2] Includes Filter Operator, Ginding-Mill Operator and Solution Man.

Occupation and Locality	Wage Rate per Hour	
	Average	Predominant Range
	$	$
Tradesman's Helper		
Canada	1.22	....
Quebec	1.17	1.05—1.28
Ontario	1.24	1.15—1.30
Truck Driver		
Canada	1.30	....
Quebec	1.26	1.15—1.30
Ontario	1.30	1.23—1.41
British Columbia	1.46	1.44—1.50

Occupation and Locality	Wage Rate per Hour: Average	Wage Rate per Hour: Predominant Range
	$	$
Standard Hours per Week		
Average / *Range*		
Canada............. 41.0 / 40—48		
Open-Pit Workers		
Canada		
Blaster	1.75	1.53—1.95
Bulldozer Operator	1.90	1.70—2.00
Drill Operator	1.85	1.60—2.00
Oiler	1.65	1.55—1.85
Shovel Operator (Power Shovel Operator)	2.26	2.25—2.30
Truck Driver	1.89	1.85—2.00
Underground Workers		
Hoistman	1.82	1.72—2.05
Miner		
Basic Rate	1.90	1.77—2.00
Straight-time Earnings	2.57	2.13—3.04
Motorman (Motor Operator)	1.75	1.72—1.80
Mucking Machine Operator	1.84	1.77—1.89
Pipefitter	1.79	1.53—1.91
Timberman (Shaft Timberman)	1.72	1.61—1.95
Surface and Mill Workers		
Carpenter	1.88	1.82—2.15
Crusher Operator (Crusherman)	1.75	1.58—1.85
Electrician	2.02	1.70—2.25
Labourer	1.44	1.20—1.60
Machinist	1.98	1.75—2.15
Maintenance Mechanic	1.92	1.70—2.05
Steel Sharpener (Bit Grinder; Bit Sharpener)	1.72	1.61—1.85
Tradesman's Helper	1.62	1.50—1.90

Occupation and Locality			Wage Rate per Hour: Average	Wage Rate per Hour: Predominant Range
			$	$
Standard Hours per Week				
	Average	*Range*		
Canada	42.3	......		
Quebec	45.6	44—54		
Ontario	40.1	40—44		
British Columbia	41.0	40—44		
Underground Workers				
Cage and Skip Tender				
Canada			1.90	....
Quebec			1.61	1.38—1.68
Ontario			2.12	2.04—2.17
British Columbia			1.69	1.56—1.80
Chute Blaster				
Canada			1.94	....
Quebec			1.62	1.41—1.65
Ontario			2.06	2.04—2.08
British Columbia			1.78	1.69—1.85
Deckman				
Canada			1.70	....
Quebec			1.50	1.38—1.60
Ontario			1.93	1.87—1.96
Hoistman				
Canada			2.00	....
Quebec			1.79	1.50—1.89
Ontario			2.27	2.17—2.33
British Columbia			1.80	1.61—2.02

Occupation and Locality	Wage Rate per Hour	
	Average	Predominant Range
	$	$
Labourer		
Canada	1.84	....
Quebec	1.39	1.28—1.41
Ontario	1.93	1.87—1.97
British Columbia	1.58	1.38—1.80
Miner		
Canada	1.85	....
Quebec	1.62	1.53—1.65
Ontario	2.01	1.96—2.08
British Columbia	1.81	1.63—2.02
Miner's Helper		
Canada	1.57	....
Quebec	1.49	1.41—1.51
Ontario	1.84	1.61—1.87
British Columbia	1.53	1.43—1.61
Motorman (Motor Operator)		
Canada	1.86	....
Quebec	1.53	1.18—1.65
Ontario	2.06	2.04—2.08
British Columbia	1.65	1.53—1.70
Mucking-Machine Operator		
Canada	1.97	....
Quebec	1.60	1.48—1.70
Ontario	2.05	1.96—2.08
British Columbia	1.60	1.56—1.73
Mucker and Trammer (Shoveller)		
Canada	1.77	....
Quebec	1.46	1.26—1.51
Ontario	1.92	1.70—1.97
British Columbia	1.57	1.49—1.58

Occupation and Locality	Wage Rate per Hour	
	Average	Predominant Range
	$	$
Pipefitter		
Canada	1.82	....
Quebec	1.66	1.50—1.82
Ontario	2.16	2.09—2.33
British Columbia	1.87	1.70—2.13
Timberman (Shaft Timberman)		
Canada	2.00	....
Quebec	1.66	1.53—1.77
Ontario	2.08	2.04—2.08
British Columbia	1.92	1.76—2.02
Trackman		
Canada	1.91	....
Quebec	1.58	1.28—1.67
Ontario	2.06	1.96—2.08
British Columbia	1.74	1.69—1.80
Surface and Mill Workers		
Carpenter		
Canada	1.82	....
Quebec	1.58	1.50—1.66
Ontario	2.19	2.09—2.33
British Columbia	1.93	1.77—2.13
Crusher Operator (Crusherman)		
Canada	1.78	....
Quebec	1.50	1.38—1.60
Ontario	2.03	1.97—2.08
British Columbia	1.64	1.50—1.77
Electrician		
Canada	2.08	....
Quebec	1.69	1.51—1.82
Ontario	2.26	2.09—2.33
British Columbia	1.96	1.77—2.18

Occupation and Locality	Wage Rate per Hour: Average	Wage Rate per Hour: Predominant Range
	$	$
Labourer		
Canada	1.53	....
Quebec	1.28	1.13—1.41
Ontario	1.76	1.53—1.81
British Columbia	1.55	1.40—1.63
Machinist		
Canada	2.05	....
Quebec	1.71	1.59—1.82
Ontario	2.24	2.09—2.33
British Columbia	2.03	1.91—2.13
Maintenance Mechanic		
Canada	1.92	....
Quebec	1.68	1.51—1.82
Ontario	2.24	2.09—2.33
British Columbia	1.88	1.74—2.07
Millman[1]		
Canada	1.75	....
Quebec	1.51	1.36—1.60
Ontario	2.01	1.83—2.13
British Columbia	1.66	1.50—1.77
Steel Sharpener (Bit Grinder; Bit Sharpener)		
Canada	1.74	....
Quebec	1.57	1.44—1.74
Ontario	2.08	1.93—2.29
British Columbia	1.84	1.73—1.91
Tradesman's Helper		
Canada	1.73	....
Quebec	1.46	1.40—1.49
Ontario	1.91	1.87—1.97
British Columbia	1.60	1.54—1.74
Truck Driver		
Canada	1.69	....
Quebec	1.35	1.23—1.41
Ontario	1.85	1.82—2.08
British Columbia	1.68	1.53—1.80

[1] Includes Filter Operator, Grinding-Mill Operator and Solution Man.

Occupation and Locality			Wage Rate per Day: Average	Wage Rate per Day: Predominant Range
			$	$
Standard Hours	*per Day*	*Range per Week*		
Canada	8	......		
Nova Scotia	8	40—48		
Alberta	8	40—46		
British Columbia	8	40—44		
Blacksmith—Surface and Underground				
Canada			11.42	....
Nova Scotia			10.54	10.13—11.76
Alberta			13.17	13.14—13.25
Carpenter—Surface and Underground				
Canada			10.84	....
Nova Scotia			10.31	10.24—10.43
Alberta			13.13	12.76—13.25
British Columbia			13.11	13.04—13.25
Driver, Horse				
Canada			11.47	....
Alberta			12.78	10.88—12.88
Fire Boss				
Canada			13.35	....
Nova Scotia			10.48	10.38—11.00
Alberta			15.20	14.95—15.69
British Columbia			15.73	....
Hoistman, Surface (Hoisting Engineer)				
Canada			11.12	....
Nova Scotia			10.54	9.56—11.35
Alberta			13.15	12.77—13.31

[1] Does not include open-pit coal mining.

Occupation and Locality	Wage Rate per Day	
	Average	Predominant Range
	$	$
Hoistman, Underground (Hoisting Engineer)		
Canada	10.34	....
Nova Scotia	9.89	9.74—10.30
Alberta	12.82	12.77—13.19
British Columbia	12.89	12.76—13.15
Labourer, Surface		
Canada	10.66	....
Nova Scotia	9.66	8.00— 9.74
Alberta	12.30	11.99—12.94
British Columbia	12.19	12.06—12.27
Labourer, Underground		
Canada	10.14	....
Nova Scotia	9.69	9.00— 9.74
Alberta	12.86	12.27—13.87
Loader and Bucker		
Canada	12.29	....
Alberta	12.61	12.27—12.88
Machinist — Surface and Underground		
Canada	11.91	....
Nova Scotia	11.46	11.18—11.76
Alberta	13.16	12.88—13.30
British Columbia	13.22	13.04—13.25
Mechanic—Surface and Underground		
Canada	10.78	....
Nova Scotia	10.54	10.30—10.55
Alberta	13.50	12.76—19.62
British Columbia	13.18	12.94—13.25
Miner, Contract		
Canada	15.33	....
Nova Scotia	14.21	12.03—15.19
Alberta	17.78	13.00—22.50

Occupation and Locality	Wage Rate per Day	
	Average	Predominant Range
	$	$
Miner, Datal		
Canada	12.91	....
Nova Scotia	11.58	9.20—13.00
Alberta	13.75	12.94—13.87
British Columbia	13.44	12.94—13.63
Miner (Machine Cutter; Machine Driller; Machine Loader), Contract		
Canada	15.17	....
Nova Scotia	14.81	12.29—16.50
Alberta	18.52	16.68—23.90
Miner (Machine Cutter; Machine Driller; Machine Loader), Datal		
Canada	13.03	....
Nova Scotia	12.50	10.70—17.10
Alberta	14.31	13.15—14.92
British Columbia	13.86	12.59—14.67
Motorman (Haulage Engineer)		
Canada	11.35	....
Nova Scotia	10.41	9.74—10.85
Alberta	12.80	12.76—12.88
Rope Rider and Brakeman (Chain Runner; Trip Rider)		
Canada	10.30	....
Nova Scotia	9.77	9.74— 9.86
Alberta	12.63	12.22—12.94
British Columbia	12.64	12.55—12.76
Screenman		
Canada	9.98	....
Nova Scotia	9.70	9.00—10.01
Alberta	12.30	12.07—12.76
Timberman		
Canada	10.61	....
Nova Scotia	10.43	9.84—10.85
Alberta	13.22	12.94—13.87
British Columbia	13.08	12.94—13.15

LOCAL INFORMATION

"CANADIAN OCCUPATIONS" SERIES

Monographs and Pamphlets

The monographs listed below, accompanied by pamphlets, except in the case of numbers 11, 12, 13, 39 and 42 have been published to date.

(1) Carpenter
(2) Bricklayers and Stone-Masons
(3) Plasterer
(4) Painter
(5) Plumber, Pipe Fitter and Steam Fitter
(6) Sheet-Metal Worker
(7) Electrician
(8) Machinist and Machine Operators (Metal)
(9) Printing Trades
(10) Motor Vehicle Mechanic
(11) Optometrist
(12) Social Worker
(13) Lawyer
(14) Mining Occupations
(15) Foundry Workers
(16) Technical Occupations in Radio and Electronics
(17) Forge Shop Occupations
(18) Tool and Die Makers
(19) Railway Careers

Careers in Natural Science and Engineering: (20-35, one booklet)

(20) Agricultural Scientist
(21) Architect
(22) Biologist
(23) Chemist
(24) Geologist
(25) Physicist
(26) Aeronautical Engineer
(27) ——
(28) Chemical Engineer
(29) Civil Engineer
(30) Electrical Engineer
(31) Forest Engineer and Forest Scientist
(32) Mechanical Engineer
(33) Metallurgical Engineer
(34) Mining Engineer
(35) Petroleum Engineer

(36) Hospital Workers (Other than Professional)
(37) Draughtsman
(38) Welder
(39) Careers in Home Economics
(40) Occupations in the Aircraft Manufacturing Industry
(41) Careers in Construction
(42) Medical Laboratory Technologist

Filmstrips

The Department of Labour has prepared, to date, the following occupational filmstrips in collaboration with the National Film Board. A manual has been prepared as an accompaniment to each filmstrip. These may be purchased from the National Film Board, Box 6100, Montreal, or from any one of its regional offices.

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Bricklayer and Stone-Mason
Printing Trades
Careers in Natural Science
Careers in Home Economics
Motor Vehicle Mechanic
Mining Occupations
Draughtsman
Careers in Construction

DEPARTMENT OF LABOUR

Economics and Research Branch

CANADA, 1957

OTTAWA
EDMOND CLOUTIER, C.M.G., O.A., D.S.P.
QUEEN'S PRINTER AND CONTROLLER OF STATIONERY

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Canadian Occupations
Monograph 14

MINING OCCUPATIONS

Prepared
by the
Economics and Research Branch
of the
Department of Labour, Canada

HON. ALLAN J. MacEACHEN
MINISTER

GEORGE V. HAYTHORNE
DEPUTY MINISTER

First Edition 1951
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FOREWORD

During recent years there has been a steadily increasing demand for Canadian occupational information. The demand comes from young people faced with the need of choosing an occupation and preparing for it; from parents, teachers and vocational guidance counsellors; from workers wishing to change their occupations; from employment service officers; from personnel directors and union officials; from prospective immigrants to Canada and from other quarters.

THE CANADIAN OCCUPATIONS series of monographs is designed to help meet this demand. Each booklet describes, among other things, the nature of the occupation or groups of occupations, entrance and training requirements, working conditions and employment outlook.

The series has been prepared with the generous assistance of representatives of management, trade unions and professional associations. The co-operation of the Unemployment Insurance Commission, the Technical and Vocational Training Branch of the Department of Labour, and the Dominion Bureau of Statistics is gratefully acknowledged.

Occupational information tends to become dated as a result of changes in economic conditions, in industrial technology and in wage and salary structure. Revision of outdated publications is a regular feature of the series.

This booklet was prepared and written for the Manpower Resources Division by William Coe under the direction of William Allison, Head of the Occupational Analysis Section.

The branch is greatly indebted to the many organizations and companies whose assistance made this monograph possible.

J. P. FRANCIS,
Director,
Economics and Research Branch,
Department of Labour.

May 1963

CONTENTS

	Page
HISTORY AND IMPORTANCE	7
FIELDS OF WORK	9
NATURE OF WORK	12
EXPLORATION	12
Prospecting	12
Assaying	13
Diamond Drilling	14
Surveying	14
MINE DEVELOPMENT	16
MINING (Other than Coal)	17
Open-pit Mines	17
Underground Mines	19
Shaft Sinking	19
Installation of Equipment	19
Production Workers	22
Ore Treatment	25
COAL MINING	26
Strip Mines	26
Underground Mines	26
Production Workers	28
Preparation and Shipping Workers	31
WELL DRILLING	33
Oil and Natural Gas	33
PREPARATION AND TRAINING	37
PERSONAL QUALITIES NEEDED	38
ADVANCEMENT	38
WORKING CONDITIONS	40
ORGANIZATIONS	41
EMPLOYMENT OUTLOOK	41
SEEKING EMPLOYMENT	42
EARNINGS	42
Table 1 — Wage Rates — Coal Mining	44
Table 2 — Wage Rates — Gold Mining	45
Table 3 — Wage Rates — Iron Mining	46
Table 4 — Wage Rates — Metal Mining	47

MINING OCCUPATIONS

HISTORY AND IMPORTANCE

The history of mining and the utilization of mineral wealth is the history of Canada's economic development itself. Early explorers attracted by visible resources — chiefly furs — stayed to open up the continent of the New World. Hidden below ground was a vast treasure trove of mineral wealth; even today it is doubtful whether a full realization of these riches has been reached.

Mining, in the first historical period, was primarily to fill local needs. Records indicate however that Cartier was interested in the source of copper worn by the Indians and that copper deposits around Lake Superior attracted the attention of New France. Later, demands for permanent structures were to open up quarries for building stone and for materials to feed lime kilns and brick-and-tile plants around Trois Rivieres and Quebec City.

After 1763, the new regime continued to develop the mining enterprises initiated by the French. Coal mines in Cape Breton were opened up; iron deposits around Trois Rivieres were mined; and, in the St. Maurice Valley, forges turned out bar iron and cast stoves, cooking pots and plowshares.

During the early 1800's, further mineral deposits were discovered but their development, handicapped as it was by lack of roads and transportation, was sporadic. Sudden demands however would spark off an industry; for example, discovery of gold in California created a demand for smelter fuel. The search for fuel led to the west coast of Canada; coal deposits were mined in Nanaimo; and a thriving coal export business commenced.

With the ending of the California gold strikes, miners cast their eyes northward to discover gold in Canada's Fraser Valley. They pushed on into the Cariboo, and the gold rush of 1859 was on. Within a few decades, mining was to extend from gold to other minerals. In the East Kootenays and Slocan districts of British Columbia, silver-lead-zinc deposits were mined; and smelting operations at Trail resulted in coal being mined for fuel.

In Eastern Canada too, development of minerals continued. Placer gold was taken from the Chaudiere River (Quebec) in 1863; silver from the Lake Superior region in 1874; phosphates from Buckingham; and iron ore from Madoc and Marmora Townships in 1870. Oil was discovered in the 1850's oozing out of the banks of Bear Creek in the district to be aptly named Petrolia by its first postmaster. But probably the most important find of this period was the Sudbury nickel deposits in 1888.

As Canada moved into the 20th century there was great activity in roadbuilding, railways and shipping — the industrialization period had arrived. Industrialization created not only a demand for minerals but also provided transportation from the then-remote mineral deposits and to the overseas markets for the gold, lead, silver, coal, copper, zinc and silver mines which were opened up.

Following the brief postwar slump came the boom of the twenties and a variety of minerals other than those mentioned were mined, but generally in small quantities. And this continued until the world-wide depression of the thirties.

With the outbreak of World War II, there was a tremendous upsurge in mining activities, later to be intensified by the growth of postwar prosperity and demands for raw materials by war-torn countries. Mineral production expanded in value more than 2½ times (from 1,045 million dollars in 1950, to 2,843 million dollars in 1962). In fact, so great has been the utilization of Canada's mineral wealth in recent years that space permits but few of the highlights.

The change in Canada's iron ore picture typifies this expansion era. Prior to 1939, Canada produced almost no iron ore; for the next five years, iron output was from the Helen Mine

in Michipicoten; 1944 saw the opening of the tremendous open pits at Steep Rock; and development of the vast deposits on the Quebec/Labrador border began in 1954.

Other highlights include the discovery of vast oil deposits at Leduc, Alberta in 1947 and of natural gas deposits which were to result in the establishment of the petrochemical industries in Western Canada. The Atomic Age mineral — uranium — was discovered at Beaverlodge on Lake Athabasca, and at Blind River and Bancroft.

Further significant developments are under way: a 438-mile railway is under construction from Grimshaw, Alberta to the lead-zinc deposits on the south shore of Great Slave Lake in the Northwest Territories; the federal "Roads-to-Resources" and "Northern Development Roads" programs to hitherto inaccessible mineral regions are nearing completion; and new or renewed production is being developed in many provinces.

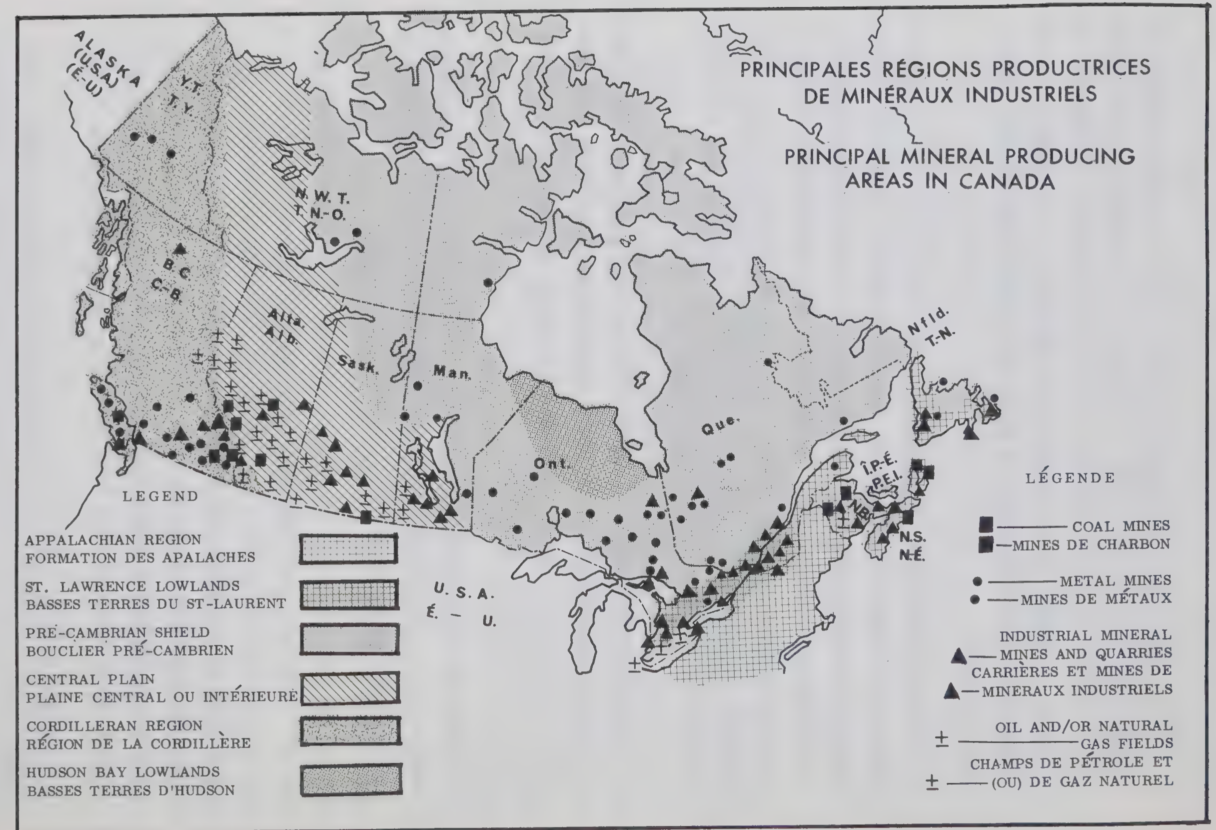
Less spectacular, but of equal importance, have been the 20th century improvements in locating, extracting, processing and utilizing of minerals; and of mechanized cutting, handling and loading and strip-mining techniques.

Little of this progress however would have been possible without the skills, knowledge and experience of many workers in occupations about to be described in this booklet.

FIELDS OF WORK

Mining occupations will be found throughout Canada. However, the minerals recovered, the kind of mining and hence the specialized occupations related to certain minerals, depend on geological structure and will be found in a particular region.

Canada consists of several geological regions, the main ones being shown on the illustration "Principal Mineral Producing Areas of Canada".



PRINCIPALES RÉGIONS PRODUCTRICES DE MINÉRAUX INDUSTRIELS
PRINCIPAL MINERAL PRODUCING AREAS IN CANADA
ALASKA (U.S.A.) (É.-U.)
Y.T. T.Y.
N.W.T. T.N.-O.
B.C. C.-B.
Alta. Alb.
Sask.
Man.
Ont.
Que.
Nfld. T.-N.
Î.P.-É. P.E.I.
N.B.
N.S. N.É.
U.S.A. É.-U.
LEGEND
APPALACHIAN REGION
FORMATION DES APALACHES
ST. LAWRENCE LOWLANDS
BASSES TERRES DU ST-LAURENT
PRÉ-CAMBRIAN SHIELD
BOUCLIER PRÉ-CAMBRIEN
CENTRAL PLAIN
PLAINE CENTRAL OU INTÉRIEURE
CORDILLERAN REGION
RÉGION DE LA CORDILLÈRE
HUDSON BAY LOWLANDS
BASSES TERRES D'HUDSON
LÉGENDE
COAL MINES
MINES DE CHARBON
METAL MINES
MINES DE MÉTAUX
INDUSTRIAL MINERAL MINES AND QUARRIES
CARRIÈRES ET MINES DE MINERAUX INDUSTRIELS
OIL AND/OR NATURAL GAS FIELDS
CHAMPS DE PÉTROLE ET (OU) DE GAZ NATUREL

The Appalachian Region of the Atlantic Provinces and Eastern Townships of Quebec is one of the principal coal mining districts of Canada and a major source of asbestos. Important quantities of zinc, lead, copper and iron ore are being mined in this region and there are also mines producing silver, gold, salt, talc, tin, beryl, fluorspar, asbestos and antimony. In addition, 80 per cent of the gypsum and 95 per cent of the barite mined in Canada comes from this region.

The St. Lawrence Lowlands consist of the southwest corner of Quebec and the most southerly part of Ontario. This region provides salt, gypsum, oil and natural gas as well as structural materials such as stone, sand and gravel.

The Pre-Cambrian Shield, or the Canadian Shield, is the largest of these regions. It includes Labrador, part of Newfoundland, most of Quebec, most of Ontario, the northern sections of Manitoba and Saskatchewan, and the Northwest Territories.

This is one of the world's great hard-rock mining regions. Most of the world's supply of nickel comes from this area which has also become a major supplier of iron ore. Minerals containing gold, silver, cobalt, platinum, lead, zinc, columbium, copper, lithium and uranium are also mined.

The Central Plain is Canada's greatest source of oil and natural gas and byproducts such as sulphur. Deposits of coal, sodium sulphate, gypsum, bentonite, potash and salt are also mined.

The Cordilleran Region, comprising a wide strip of southwestern Alberta, most of British Columbia and the Yukon Territory, contains a large percentage of the coal reserves and is an important producer of lead and zinc. Gold, silver, oil, cadmium, asbestos, limestone and tungsten are also of importance in this region.

The Hudson Bay Lowlands is an area where no mining is carried out at the present time.

NATURE OF WORK

Occupations in the mining industry may be divided roughly into two groups: (1) professional and technical jobs and (2) manual jobs.

Professional and technical jobs are relatively limited in number compared with manual jobs and usually require either university or mining school training. Details of professional careers, such as geologist or mining engineer, are given in CANADIAN OCCUPATIONS BOOKLET "Careers in Engineering"; technical occupations are covered briefly in "Technicians in Science and Engineering".

This booklet deals, primarily, with manual jobs in the four main branches of mining — exploration, development, mining (both surface and underground), well drilling (oil and natural gas), as well as milling and other primary treatments and mine-to-market operations.

EXPLORATION

PROSPECTING

The search for minerals forms an exciting chapter in our history and has been an important factor in opening up the Canadian hinterland. Not many years ago, anyone with an elementary knowledge of minerals, a pick and shovel, and a willingness to endure a solitary life in the outdoors could become a prospector. Today, prospecting is a more highly skilled occupation and the *prospector* is likely to use a variety of scientific instruments. Prospecting is now often the work of small specialized teams consisting of highly trained graduates in the fields of geophysics, geology or mining engineering and their technical assistants. Nevertheless, prospecting can still be undertaken by anyone in possession of the required Licence.

Considerable advance information is usually obtained by the modern prospector. This information is derived from maps and photographs obtained from surveys made with aerial cameras and magnetometers as well as from maps prepared by ground survey parties.

Use of modern equipment including small portable diamond drills has greatly assisted exploration. This equipment is operated by technical crews which include *draftsmen, computers, plane tablemen* and *operators* of electrical and other measurement devices.

When the prospector makes a "find", especially if it is in a promising geological formation, he may stake the area and proceed to "prove" his find. Samples of the find are sent to the assayer for analysis of mineral content.

ASSAYING

The *assayer* crushes and grinds the samples to the required fineness and then makes chemical analyses to determine the value of mineral content. Results of the findings are important in determining whether the deposit can be developed into an economical mining operation.

When a mine is in operation, the assayer checks the value of mine production by analyzing samples of the ore being removed. A *sampler* collects the required samples from various parts of the mine. Using mechanical or hand tools, he drills, cuts, grooves, channels or chips small pieces off the working faces or selects samples from conveyors, bins or cars. He bags the samples, labels them and keeps records of where they were obtained. He may plot on a map the locations from which the samples were taken. In some mines, each working face is tested daily with an instrument similar to a Geiger counter which indicates the amount of mineral per ton of ore.

DIAMOND DRILLING

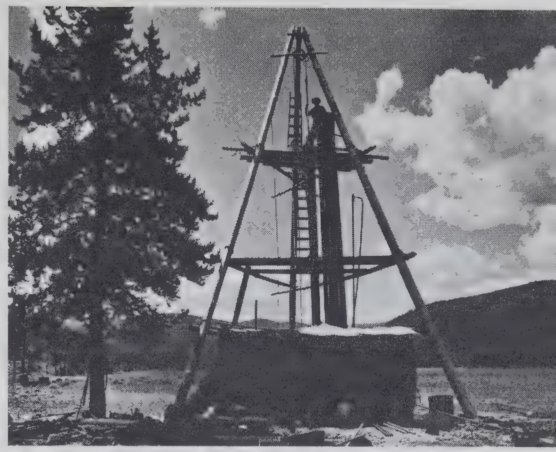
If initial tests are promising, *diamond drillers* continue the work of the prospecting crews. They seek to outline the size and shape of the deposit and determine its value by obtaining samples from below ground.

The drillers use hollow rotary drill rods with a diamond cutting ring at the forward end of the rod. The cylindrical piece of rock, or "core", cut by the diamond ring, is retained within a special core barrel and brought to the surface. It is then examined by a geologist or mining engineer, labelled as to location, depth and angle from which it was obtained, and sent to the assay office for analysis.

Drilling does not end with the discovery of the mineral deposit. After a mine has been established, the diamond driller continues to probe the deposit. Working from one or more underground levels of the mine, he seeks out the continuation of the mineral and the direction in which it lies.

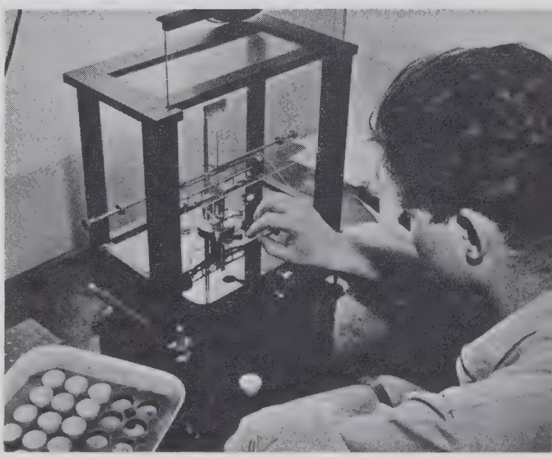
SURVEYING

The *mine surveyor* surveys the mine area and marks on maps the location of all water courses, outcrops of mineral deposits, variations in ground levels and other important physical features. As development progresses, the surveyor keeps maps up to date and indicates any changes. He also makes accurate plans of all underground workings showing shafts, drifts, crosscuts, worked-out areas, abandoned stopes and tunnels, as well as the location of veins of ore. These drawings aid in maintaining safe working conditions and also in plotting the course of future workings.



Diamond drills are used to obtain core samples in the exploration of the shores of Lake Moyie in south-eastern British Columbia.
Cominco photo

Scientific instruments are a valuable aid to this prospecting crew.
NFB photo



In the assay laboratory, ore samples are weighed and analysed for mineral content.
NFB photo

MINE DEVELOPMENT

Development of a new mine is a specialized construction job, designed to set the stage for systematic extraction and processing of ore. As many new mines are located in remote areas, it is usual to construct a road or even a railway to transport men, equipment and supplies to the areas and, later, minerals to the consumer. In very remote regions, air transportation is required and landing strips are constructed.

Surface buildings for milling ore, storing supplies, housing equipment, workshops and powerhouses, as well as living quarters for the workers, must be erected. Eventually, if the mine develops satisfactorily, the mining camp must be enlarged to include homes for the workers' families, schools, recreation centres and all the facilities necessary to a community. A successful mining venture therefore provides employment opportunities for many people in occupations other than mining.

Mining occupations may be either on the surface or underground. Factors such as the previously mentioned geological features also the size, shape and depth of the deposit, and the value of mineral contained determine the type of mine to be developed.

Work on the *surface* may be in

(a) open-pit mines or,
(b) strip mining or,
(c) drilling.

Work *underground* may be in

(a) metal mines or certain industrial mineral mines, or
(b) coal mines.

In addition, there is surface work connected with underground mines, in milling, smelting and refining plants and in mine-to-market operations.

OPEN-PIT MINES

The first operation in open-pit mining is the removal of overburden which may vary in thickness from a few feet of loose earth to several hundred feet of hard rock. Overburden is removed by *bulldozer operators, power-shovel* or *dragline operators, truck drivers, crane operators* and other operators of huge earth-moving equipment. In the case of hard rock overburden, drilling and blasting is also undertaken.

Exposed ore is then mined out in a series of steps. The usual practice is to work down from the top or into the side of a hill, although some open-pit mines such as those at Steep Rock, Ontario, and Black Lake, Quebec, have been formed by draining a lake and dredging to expose the ore.

After the overburden has been removed, *drillers,* skilled in the use of rotary and percussion type drills, bore a series of holes into the exposed ore; this exposure is called the "face". A long section of the face is usually drilled at the same time by a battery of drills under the supervision of an experienced driller called the *drill foreman* or *shift boss*. Blast holes are charged by the *blaster* (in some cases by the driller) with the amount of explosive required to break down the desired section of wall. The *pit foreman,* who is in charge of all phases of open-pit mining, detonates the charges. Before work resumes, *scalers* examine the new faces and pry away any loose rock that may be a danger to those working below.

Ore dislodged by blasting in boulders too large to be handled by power shovels is broken up by *drillers* using pneumatic drills. Or, instead of drilling, this secondary breakage is often undertaken by crane operators who raise heavy weights called "drop balls" and release them onto the boulders.

Power-shovel operators then load the loose ore into heavy trucks using mechanical shovels. *Truck drivers* haul the ore out and deliver it to the ore crusher where its treatment is begun. Most of these skilled workers have *helpers* who assist while learning the skills of the job.

In open-pit mines, exposed ore is mined out in steps or benches.
NFB photo

A power-driven drill is driving blast holes on a bench of the Gaspé copper mines.
NFB photo

This electric shovel loads 4½ cubic yards of ore per scoop, at the open-pit Marmora iron mines.
NFB photo

UNDERGROUND MINES

Development of an underground mine is a most complex and expensive operation. The work includes shaft sinking, drifting (tunneling), and the installation of surface and underground systems of transportation, ventilation, power (compressed air and electrical), water supply and drainage.

The *mine manager,* usually a graduate mining engineer, is responsible for all phases of mine development, production and production control. He is assisted by *mine superintendents* who are also usually mining engineers.

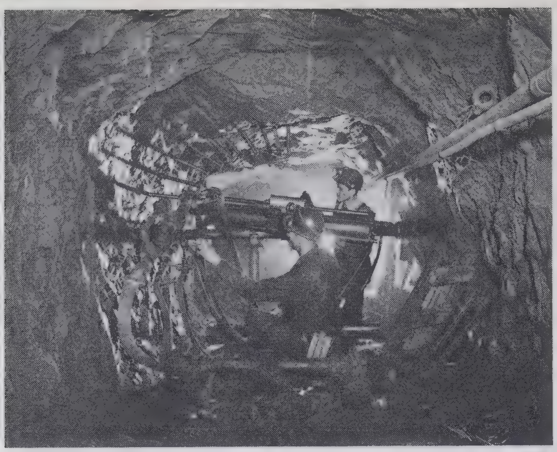
Shaft Sinking

Shafts are sunk by crews of *shaftmen;* they are experienced miners specializing in this work. They drill, blast and muck out the floor of the shaft. As the shaft is deepened, the walls may be timbered and, at regular intervals — usually 100 to 200 feet — enlarged areas called "stations" are cut out and "levels" established.

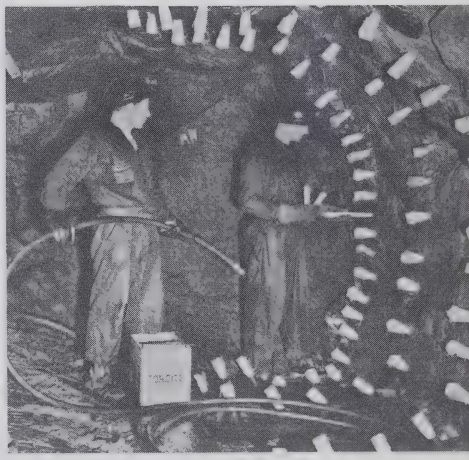
"Crosscuts" are driven through the barren rock from the shaft stations to the ore body and then drifts are driven along the ore body. In driving these subterranean passageways, skilled *driftmen* bore holes in the face of the tunnel and then install and set off charges of explosives. The miners "bar" down any loose rock from the walls and roof and remove the broken rock by mechanical loaders for hoisting to the surface.

Installation of Equipment

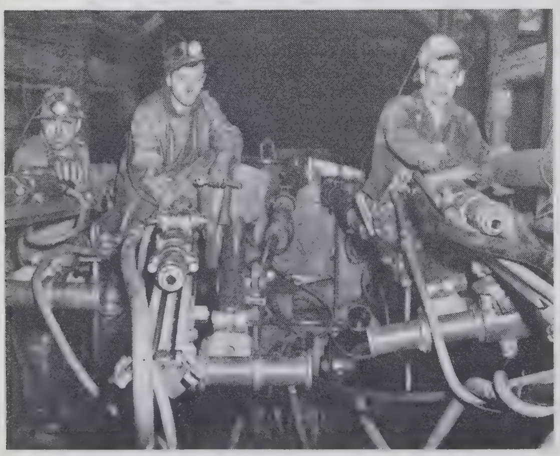
As development of the mine proceeds, certain machinery and equipment are necessary for the operation and safety of the mine.



A predetermined pattern of holes is sunk into the face with a diamond drill. The miners using this equipment are called stopers, drifters or raisers.
NFB photo



Into the pattern of drilled holes, explosives are inserted by the blasting crew.
NFB photo



This is an advanced type of multiple tool rock drill in operation in the Steep Rock iron mines near Atikokan, Ontario.
NFB photo

Skilled *mechanics* install hoisting equipment at the top of the shaft for conveying men, materials and ore. *Timbermen,* usually experienced miners with carpentry skills, cut, fit and install timbers in the passageways of the mine to support the walls and roof. In some cases they use rock bolts, steel beams and braces and hydraulic jacks, instead of timbers. They also build the chutes, cribs, ladders and other framework needed in the mine.

Pumpmen are needed to attend the power-driven pumps which remove the water occurring in many underground workings. In addition, water is essential in drilling all types of hardrock mining and is pumped underground under pressure. This water is required to help keep the drill bits cool, to wash the drill faces and to damp down and thus control dust.

Trackmen lay and maintain the system of tracks needed in undergound haulageways for mine trains. Conveyor belt systems and trackless mining equipment are supplanting mine cars in the conveying of ore and coal out of some mines.

Most mines are illuminated and much of the equipment is powered by electricity. *Electricians,* trained through apprenticeship*, install and maintain mine electrical equipment.

Steam, electric, or diesel-powered air compressors operated by *compressormen,* supply compressed air for the operation of drills and other pneumatic equipment. *Pipe fitters* install and maintain the system of compressed-air pipes and water pipes leading to the working areas of the mine.

Ventilation systems are used to keep working conditions as safe and healthy as possible. *Fan men* supervise the operation of the large fans which send fresh air coursing through the mine workings.

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*Details of apprenticeship training for electricians will be found, should further information be required, in CANADIAN OCCUPATIONS booklet, *Electrical* and *Electronic Occupations.*

Mine mechanics maintain and repair machinery and mechanical equipment used in the mine. They oil, grease and clean the equipment, examine it for defects and repair or replace worn or broken parts. While primarily concerned with keeping installed equipment in operation, they may also work on the installation of new machinery.

In addition to those already described, other workers are necessary in the development of a mine as well as in its operation and maintenance. As much of this work is common to several industries, only brief mention is made. *Tool* and *steel sharpeners* shape, sharpen and temper drill steel and bits. *Machinists* make new or replacement parts for the mechanical equipment used in the mine. *Blacksmiths* forge metal parts necessary for the repair of machines and other equipment. *Diesel mechanics* service and repair diesel engines used in and about the mine. *Welders* fabricate metal parts and also repair damaged equipment. Tradesmens' helpers assist the tradesmen and clean the work areas, machines and equipment. These helpers may also be required to perform routine machine operations such as feeding or unloading a machine and holding tools or equipment.

Production Workers

Miner is the general title used to designate the group of workers who carry out the duties required to extract ore, rock, coal or other material and transport it to the surface. Miners are usually known by the machines or equipment they operate (drillers, mucking-machine operators) or the work they do (blaster, mucker).

The *driller* works at the extraction face and uses a pneumatic drill to bore a pattern of holes into the ore body. These holes are charged with explosives by the *blaster* and wired or fused so as to explode in a pre-determined sequence. The miners then make arrangements for safeguarding all entrances to the area and, when all is clear, the charges are detonated.

Ore that has been broken down by drilling and blasting is moved out of the stope by the *mucker* either directly into mine cars, or onto conveyors or chutes from which the mine cars are loaded. The mucker may operate a mechanical scraper or "slusher"

to drag the loose ore into the chute. In some mines, a *mucking-machine operator* sets up and operates a mechanical shovel or scraper-type loader. This machine scoops up the ore and loads it into mine cars, or chutes, or onto a conveyor belt.

Usually ore cars are loaded from a chute that connects the stope area to the haulageway below, making gravity do most of the work. It is the duty of the *chute blaster* to keep the ore flowing freely. The flow of ore out of the chute is controlled by a loading gate. Should the chute become clogged the chute blaster has to clear the stoppage. If the stoppage is such that is cannot be loosened by barring, the chute blaster may have to drill and blast to restart the flow. The chute blaster may assist underground trammers in loading ore cars and assembling them in trains.

Trammers operate small locomotives moving the loaded ore cars along the passage to the main haulageways and empty ones back to the working place. They may also help load and unload the ore cars.

Locomotives, operated by *motormen,* haul the trains of ore cars to the shaft stations or ore pockets. With the trains are *switchmen* who couple and uncouple the cars, throw the track switches and direct the movements of the trains by signalling the motormen. At the shaft station, loaded mine cars are either placed in the cage to be hoisted to the surface or emptied into openings leading to the loading pocket.

The *skip tender* loads the skips with ore. He controls the flow of ore through the chute from the loading pocket by operating a loading gate. He examines the loaded skips and signals the hoistmen to raise or lower them. The skip tender may also be required to take charge of other shaft conveyances and ring signals for the raising and lowering of men, supplies and equipment.

Work of the *cage tender* is similar to that of the skip tender. He communicates with the hoistman to control the movements of the cage. He may move loaded or empty cars on or off the cage

After blasting, loose rock that has not fallen is pried off. This is known as scaling or barring down.
Cominco photo

Ore from a recent blast is broken by muckers before being loaded onto underground cars.
NFB photo

Rock burden, or muck, is loaded into ore cars with this mucking machine. Before the advent of power operated shovels, mucking was done by hand.
Cominco photo

or ride the cage and assist with the loading and unloading at all levels. Occasionally, the cage tender performs the duties of the skip tender.

Loading and unloading of the cage with ore cars, equipment and supplies at the surface is done by the *deckman.*

Responsibility for safe movement of all shaft conveyances rests largely with the *hoistman* (hoisting engineer). Upon receiving electrical signals from cage or skip tenders, or the deckman, he operates hoisting equipment to raise or lower the skips or cages. The hoistman also tests the hoisting machinery daily and reports the need for any repairs necessary to keep the hoist operating safely. Further tests are made at periodic intervals by authorized electricians and mechanics.

ORE TREATMENT

Since minerals are seldom mined in the pure state, they must be separated from the worthless rock. As a rule, the ore must first be crushed before further processing can proceed. Although some of the larger mines do preliminary crushing work underground, most mines send the ore directly to a surface mill. At the mill, ore is fed into huge machines called crushers, controlled by *crusher operators,* where it is broken into gravel-sized pieces. It is then further reduced in size by grinding machines called mills, controlled by *ball* or *rod grinding-mill operators,* which pulverize the ore in water. The soupy suspension or pulp which results is then ready for further treatment.

Extraction methods depend on the nature of the mineral and the other substances present in the solution. *Solution men* operate equipment used in extracting precious metals from ore in solution. In many cases, separation of mineral from mineral, and mineral from waste, is done in a series of flotation cells under the control of a *flotation operator.* After the minerals have separated, water is removed from the concentrates by thickeners and filters controlled by *filter operators.*

COAL MINING

In contrast with the irregular formation of other ore deposits, coal seams generally occur in more regular layers, either horizontally or inclined, and range in thickness from a few inches to many feet. A significant difference between coal and most metal mining is the presence of certain hazards such as explosive gases and dust and the higher degree of roof support required in coal mines.

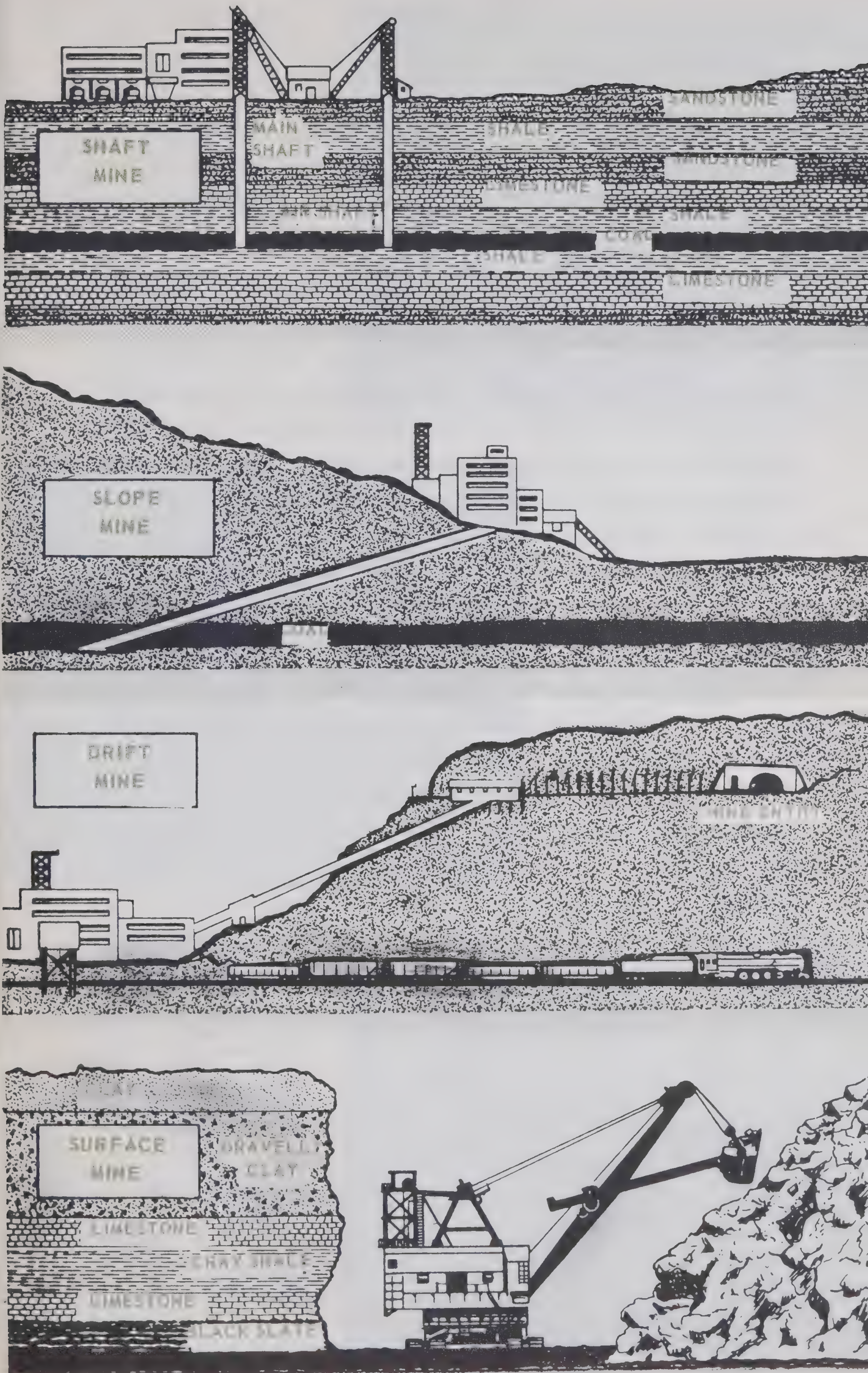
STRIP MINES

Strip mining, which is quite similar to the open-pit mining of ore previously described, is the method used when a coal deposit lies close to the surface. Overburden is removed from the coal by *dragline* or *shovel operators* and dumped into a mined-out part of the pit. Other shovel operators, drillers and truck drivers remove the coal in a ribbon or strip-like fashion ahead of the next pass made by the stripping shovel or dragline.

UNDERGROUND MINES

The term "shaft" mine, "slope" mine or "drift" mine designates the type of principal access to the coal seam. Access to the seam is gained by a vertical shaft in the shaft mine, and through an inclined shaft in a slope mine. In a drift mine, the main entry is a horizontal tunnel driven into the side of a hill, mountain or river valley.

The two methods most commonly used in extracting coal in underground mines are "room-and-pillar" mining (where pillars of coal are left standing to support the roof of the mine and, quite often, removed later) and "long-wall" mining (where the seam is completely extracted in one operation and the roof is allowed to collapse under controlled conditions). Underground mining of salt, gypsum and potash is by similar, highly-mechanized room-and-pillar methods.



SHAFT MINE
MAIN SHAFT
SANDSTONE
SHALE
LIMESTONE
SHALE
COAL
SHALE
LIMESTONE
SLOPE MINE
COAL
DRIFT MINE
SURFACE MINE
GRAVELLY CLAY
LIMESTONE
LIMESTONE
BLACK SLATE

Although many of the underground mining occupations that have been described for metal mines are also required in coal mining, they may be referred to by different occupational titles; in addition, certain jobs are peculiar to coal mining.

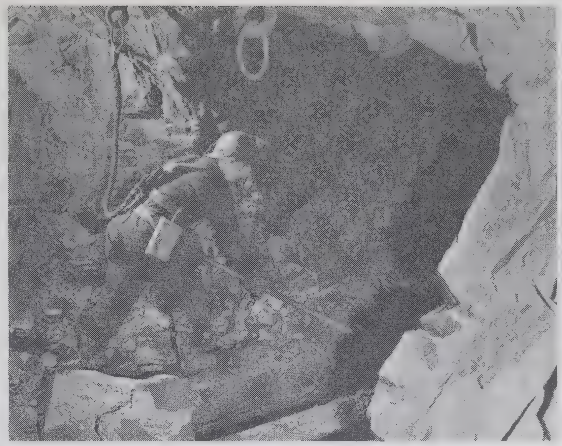
The fire boss or *overman,* like the shift boss in the metal mine, is in charge of a mine section and is responsible for production and the safety of all men working in that section. Before any work commences, he examines the section with gas testing devices such as a flame safety lamp to determine whether or not there is an excessive accumulation of mine gas in the area. He visually examines working faces and roadways for excessive accumulations of coal dust, which are also highly explosive. He ensures that all passageways are kept clear, that loose rock is removed from walls and roof, that working faces are adequately timbered and that proper ventilation is carried out.

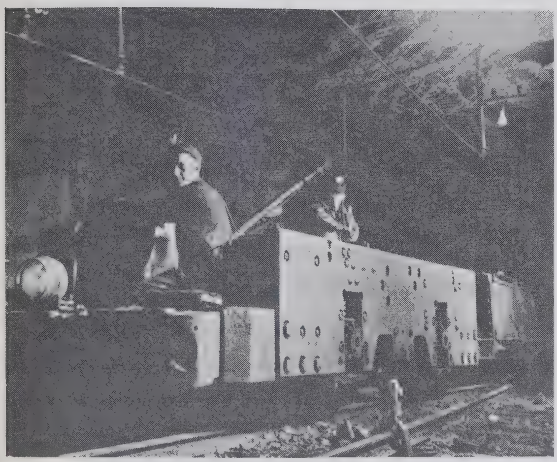
In coal mines, explosives are set off only by the *fire boss* (in some mines known as the shotfirer). When blasting has been completed, the fire boss re-examines the working faces to ensure that no fires have broken out, that all explosive charges have fired, that timbering and ventilation are adequate and that work can be safely resumed.

Owing to the presence of explosive gases, ventilation is extremely important in coal mining. The *bratticeman* helps in the control of ventilation by hanging canvas or burlap curtains to guide the air along underground passages. Using such materials as wood, brick or concrete, he also builds partitions of a more permanent nature for the same purpose.

To facilitate movement of men, material and coal, all passageways must be of adequate size and kept as clear as possible. The *brusher* is responsible for enlarging passageways, particularly in thin seams, by drilling, blasting and removing rock from the roof or floor until the desired height is attained. Generally, he is also required to install heavy, permanent roof supports such as steel arches or heavy steel rails.

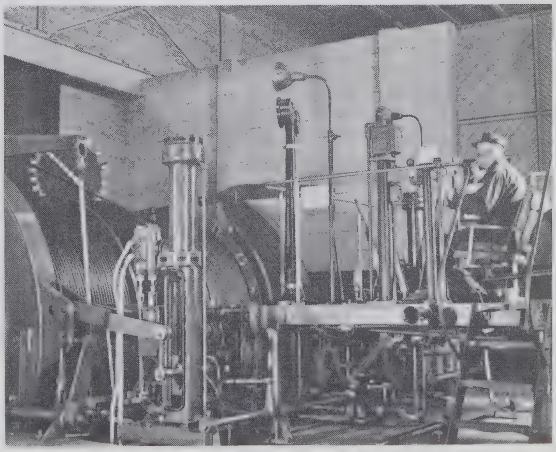
A chute connects the working or stope area to the haulageway below. The chute blaster keeps the ore flowing freely.
NFB photo





Ore is taken from haulageways to the main shaft by an electric trolley driven by a motorman.
NFB photo

The hoistman is responsible for these 1,550-horsepower, direct-current hoists used to raise miners, ore and equipment from many thousands of feet below ground.
NFB photo



The men who actually extract the coal are divided into two classifications — *contract miners* and *datal miners*. Both perform essentially the same functions, that of cutting, boring and loading coal, and erecting timbering. The contract miner, however, is paid on a tonnage or "piece-work" basis and the rates for such work are established by contract between the miners and the employer. On the other hand, the datal miner is paid a fixed daily wage.

Mining at the coal face has become highly mechanized. Mechanical cutters and boring machines have long been employed and mechanical loaders have replaced the traditional shovel. Modern coal miners have become skilled machine operators. The *machine cutter* operates a coal-cutting machine that makes a horizontal or vertical slot in the coal face to a depth of four to nine feet, thus enabling the subsequent blasting to break down the coal more efficiently. The *coal borer* uses light rotary drills to bore the cut face for insertion of explosives. As indicated, the shooting is performed by a qualified official, the shotfirer.

The *machine loader* operates a mobile machine that follows the cutters and borers and loads the coal loosened by these preceding operations. Coal is loaded by the machine into conveyors or directly into mine cars. This sequence of cutting, boring, shooting and loading is followed in the day-to-day mining of a number of adjacent coal extraction faces.

Continuous mining machines are further advances in mechanization, for they eliminate the operations of cutting, boring and blasting. This type of machine is set up at the working face and, as it advances, it digs the coal free from the solid seam and loads it onto a conveyor or into mine cars all in one continuous operation.

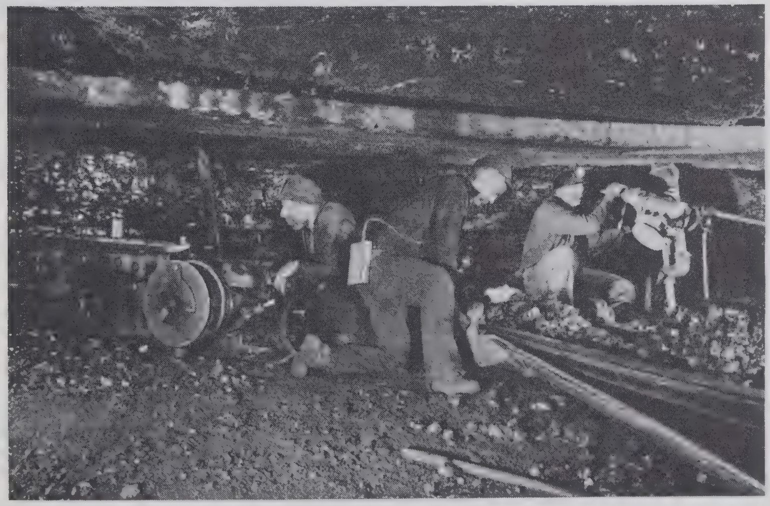
Timbering machines are also used to lighten the manual effort of erecting heavy wood or metal supports; rock-bolting machines are employed to facilitate the use of this method of holding up mine roofs.

Despite the advances made in mechanization, much manual labour must still be performed, particularly in steeply pitching

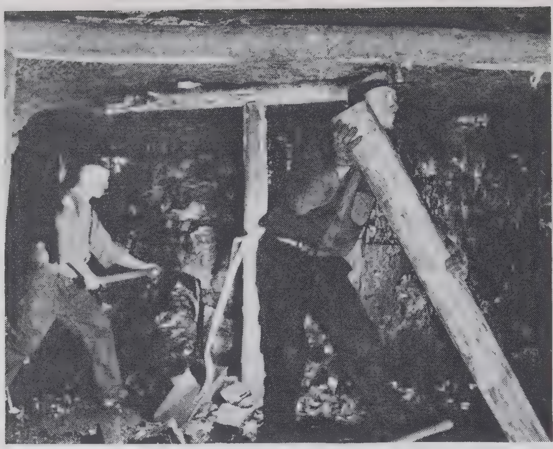
seams where it is more difficult to employ mechanized mining equipment. Even in flat-lying seams, certain operations are impractical to mechanize. In most mines also, a substantial force of maintenance men, material handlers and haulage crews is required to maintain the frequently extensive underground workings and to handle the flow of coal and rock to the surface, and materials into the mine.

Preparation and Shipping Workers

When coal is hoisted to the surface, it is weighed by a *weighman,* and then passed on to the picking belts where rock and low grade coal are removed by *rock pickers.* If large lumps of coal are present, the coal is fed to a breaking machine and passed over a series of shaker screens operated by *screenmen.* These screens separate the coal into the different sizes demanded by the market. If considerable impurities remain in these sizes, such coal is then fed to a cleaning plant where unwanted material is mechanically removed under the supervision of a *cleaning-plant operator. Car loaders,* using mechanical shovels or coal chutes, load the coal into railway boxcars or gondolas to be transported to market.

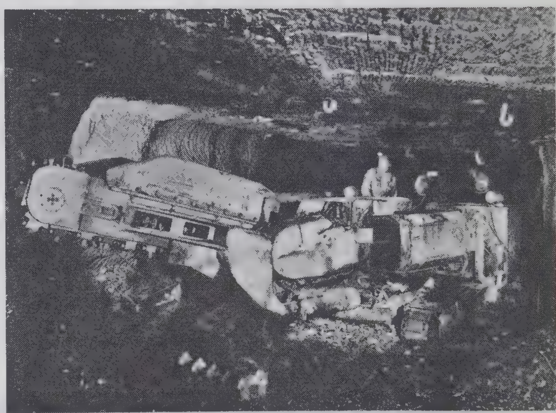


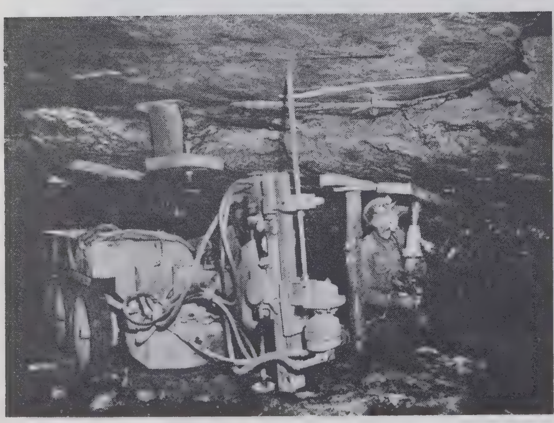
The coal miner has many skilled tasks.
NFB photo



Timbers support the roof of the mine. Machines are used to lift the heavy wood or metal supports.
NFB photo

This continuous mining machine cuts and loads coal in a single operation. Separate operations of drilling, blasting, cutting and loading are thus eliminated.
NFB photo





Rock bolting by machine is a modern method of installing metal roof supports.
NFB photo

WELL DRILLING

OIL AND NATURAL GAS

Drilling of likely sites is undertaken to determine whether oil or natural gas are present in quantities sufficient for exploitation, and once found, to drill sufficient wells to obtain maximum recovery.

Most of the drilling is carried out by contractors who operate privately owned rigs and are hired by oil companies.

Although rotary drilling rigs are a well-known sight in Western Canada, a brief explanation of the main assemblies — the derrick, draw works, power supply and mud system — is included to clarify the nature of the work.

The derrick, or mast, of structural steel members, provides clearance for wellhead equipment and control devices. Hoisting equipment, known as the "draw works" combined with cables and sheave blocks up on the derrick lift the string of drill pipe which is suspended from the centre of the derrick.

In the centre of the derrick floor is a rotary table through which a square or hexagonal drill shaft, called a "kelly", is inserted. Power applied to the rotary table turns the kelly and the attached drill pipe. A bit is attached to the end of the drill pipe and it is the chipping action of this bit, when it is rotated, that drills the hole. A swivel connection at the upper end of the kelly facilitates the passage of drilling fluid or "mud" through the pipe string.

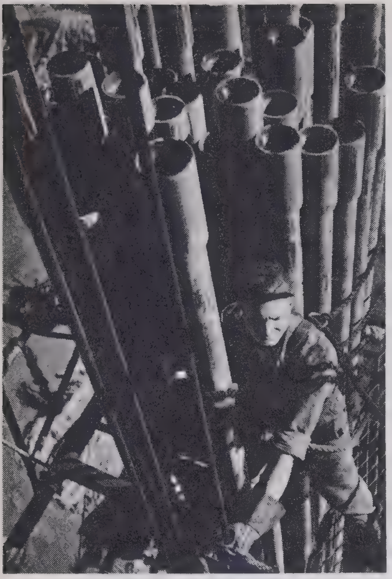
The draw works consist mainly of a hoisting drum or winch and control mechanism. From the winch a heavy steel cable goes to the top of the derrick where it enters a "crown block". The cable continues to a travelling block which, in turn, is attached to the drill string. The function of the draw works is to suspend, raise and lower the drill string as required.

Three crews of "roughnecks" operate the drill on a 24-hour, 3-shift basis. Each crew consists of several specialists whose main function is to "keep the drill at the bottom of the hole and turning to the right".

It should be noted that although separate occupations are described in the following paragraphs, in actual work various combinations of duties will be found. For example, in the province of British Columbia, it is usual for the jobs of derrickman, roustabout and pumpman to be undertaken by a single worker; or, instead of a powerman, the driller may be responsible for the engines. In the latter case, a mechanic is on call and he will be available to several rigs.

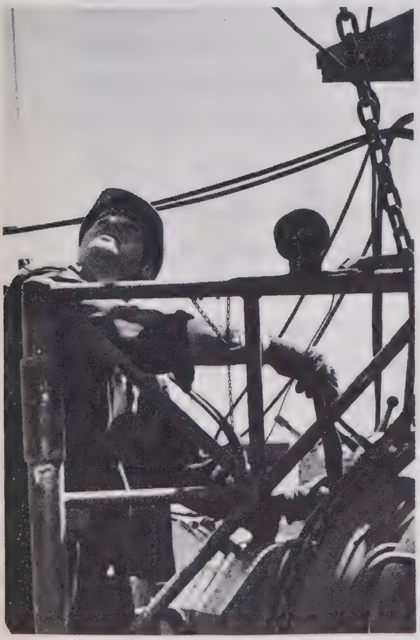
In charge of all the drill crews and responsible for all drilling operations is the *toolpusher*.

Reporting directly to the toolpusher, and responsible for the hour-to-hour operations of a single crew, is the *driller* who controls the actual drilling. Using his experience, the feel and sound of the controls, and through instrument and gauge readings, he judges what is going on at the bottom of the hole.



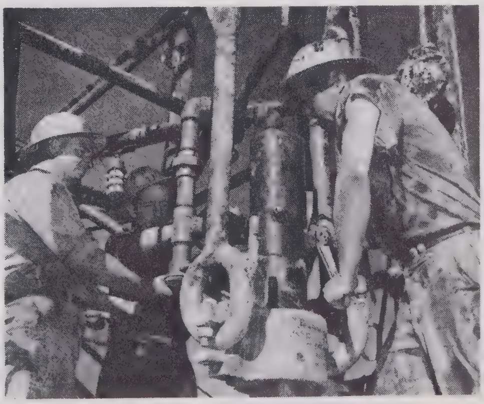
Upper left — Derrickman racks pipe from platform 90 feet above ground at Imperial Well No. 34, Alberta. —
NFB photo

Upper right — Screwing drill stem sections into column in ground at Leduc oil fields, near Devon, Alberta. —
NFB photo



Lower left — The driller manipulates the controls at the base of this oil drilling rig.
NFB photo

Lower right — The driller handling lead-tongs assisted by the cat-head operator and a roust-about release pressure off a casing. Cement will be later poured down the casing.
NFB photo



Near the top of the rig — often over one hundred feet above ground — is the *derrickman*. When the drill bit has to be changed the string of pipe sections must be hoisted from below ground. As the pipe is raised, each section is unscrewed with huge wrenches handled by other crew members. The derrickman pulls and stores the pipe sections on a rack beside his platform. This rack may contain one or more miles of pipe section before the drill bit reaches the surface. The crew replaces the old bit with a new one and the pipe is fed section by section back into the hole.

Other crew members include the *pipe racker,* who helps manoeuvre sections of pipe before they are lowered into the ground. Working on the derrick floor, the *floormen* uncouple and couple pipe sections as they are raised and lowered. Also in the crew is a *roustabout* — this is an entry occupation — who does odd jobs such as cleaning the derrick floor and racking up pipe. Some crews include a *cathead man* who operates a small cathead drum when pulling pipe or other small jobs requiring low-power lifting.

Power is supplied to the drill rig by a bank of stationary diesel engines under the control of the *powerman*. The power plant, usually six to eight engines, provides all the power requirements for the drilling rig, for hoisting, turning the rotary table, for circulating mud and for other operations.

The mud system performs a very important function in the drilling operations and is controlled by the *pumpman*. A mud of bentonite with various chemical additives is pumped through the drill pipe to the bottom of the hole where it emerges through openings in the drill bit. It then returns to the surface along the outside of the drill string. Cuttings from the bottom of the hole are brought up by the mud and these provide information to the driller. In addition, the mud cools, lubricates and gives support to the sides of the hole.

Smaller service rigs are used along with smaller crews to perform many operations of completing wells such as logging, cementing and perforating.

There is no specified standard of education for employment in mining and it is possible for persons with limited education to earn good wages. However, the person with a good formal education has a better chance of getting ahead.

Training in mining technology can be obtained at the Provincial Institute of Mining, Haileybury, Ont., at the Lakehead College of Arts, Science and Technology, Port Arthur, Ont., and the British Columbia School of Technology, Burnaby, B.C.

Each institute offers a two-year course in mining for those who have obtained a Secondary School Graduation Diploma, or its equivalent. Subjects taught include prospecting, mineralogy, geology, geological mapping, metallurgy, surveying, milling, mine ventilation, mine safety, mining methods, machinery, and law and management. Full details may be obtained by applying to the Registrars of these institutions.

Miners are trained on the job. In some of the larger mines, training classes are conducted in a special section of the mine known as the "training level" or "school stope". This period of practical training enables the beginner to become familiar with the nature of the work, the various tools and equipment and the different methods used. He also becomes acquainted with the precautions and safety regulations.

Mine officials and certain classes of miners in some provinces must obtain Certificates of Competency through examination by the provincial Department of Mines. Requirements for open-pit mines may not be as strict as those in underground mines.

Oil drillers also learn their skills on the job and elementary education is usually sufficient. However, drilling technique is so complex today that they will find more education a definite advantage and, if they wish to advance to higher positions in the oil industry, they should be prepared to improve their schooling.

Around the drilling rig, trade or technical school training in mechanics, pipefitting, welding and shopwork will be useful.

PERSONAL QUALITIES NEEDED

Minimum age limits for employment in and around a mine are governed by provincial laws and may vary from province to province. It is a general rule that no person under the age of 18 years will be permitted to work underground or at the face of a quarry.

A miner must be strong and free from serious physical handicap, especially lung trouble. Mining regulations require that all employees who work underground, and in some cases surface workers, must pass a physical examination. Working underground in close quarters calls for nerve, resourcefulness and the ability to think clearly and act quickly in an emergency.

Similar personal qualities are demanded of the oil drilling crews. They must be in excellent health and physical condition. They must have good physical co-ordination, be able to move quickly and, in an emergency, must be calm and resourceful. Because drilling is undertaken in many of the remote areas of Canada, they must be willing to travel and live under various degrees of discomfort. Mechanical aptitude is required as is the ability to get along with others. To be able to manage men is also important in crew leaders.

Because they work as part of a team and must realize the importance of complying with safety regulations, a keen sense of responsibility and co-operation are probably the most desirable qualities in mining occupations.

ADVANCEMENT

Advancement will depend on the type of mining undertaken and will be dealt with under two separate headings — mining and oilwell drilling.

MINING

There are few positions closed to a competent and ambitious worker. Underground workers usually begin as mine labourers, trammers and muckers. As they become familiar with mining procedures, they generally become mine helpers and, after acquiring the necessary knowledge and ability, advance to skilled work as equipment operators, timbermen, blasters, etc. Skilled workers having the required experience and personal qualities, can become foremen or shift bosses. A foreman, in turn, may advance to the more responsible position of mine captain or, in coal mines, underground manager or pit boss. Surface workers may rise to foremen.

Advancement for mill workers ranges from labourer to helper and then to a skilled job such as crusherman, filter operator or solution man. Foremen are promoted from the skilled workers' ranks and may advance further to the position of mill superintendent.

Workers in open-pit mines may expect a similar range of promotions. Starting as labourers, they may advance to the position of helper and then to driller or machine operator. Experienced drillers may become drill foremen and then shift bosses and eventually pit foremen.

DRILLING

The entry occupation in the oil drilling industry is that of "roustabout" or labourer. If he has the required qualities, an ambitious man can rise through the various occupations on the drilling rig to that of oil driller. Since it takes from five to ten years to reach this position, it is best to get an early start. Later he may rise to the toolpusher position or transfer to other jobs in the oil industry. Unless he has reached the driller or toolpusher position by the time he is 50 years of age, he may find it difficult to carry out the physical tasks required in drilling occupations. However, his future is dependent mainly on his ability and his drive.

In the past, miners used to encounter many discomforts and hazards. Today, those of damp, dirt and water have been considerably reduced by the wearing of special clothing, the use of pumps for drainage, and the installation of ventilating systems to supply large volumes of fresh air at reasonable temperatures. In addition, mechanization such as mucking machines, light rotary drills and the like is reducing much of the manual effort required.

Danger from falling rock, cave-ins and other factors associated with mining must be considered. Mine safety precautions are well developed and preventable accidents are kept to a minimum. The majority of mines have specially trained safety engineers whose primary job is accident prevention and the enforcement of safety regulations together with qualified first-aid men and other medical personnel.

Oil drilling is carried on the year round and in the outdoors. While outdoor work has certain advantages, it also brings exposure to sub-zero weather. The work is often in remote parts of the country and drillers live in camps which may lack the conveniences of city dwelling; however most drilling companies do try to make living conditions as comfortable as possible under the circumstances. All equipment on the drilling rig is heavy and the crew has to move quickly while handling it. There is also the danger of fire from the well and smoking is not permitted. As in all branches of mining, safety precautions and regulations are rigidly enforced under the supervision of provincial mining inspectors.

In most cases, drilling crews work an eight-hour day and seven-day week. Time off is usually accumulated over a one- or two-month period so that the crews can get home for a visit. Other drilling contractors keep the men on the job until the drilling is finished; they are then laid off so that they can have a rest before proceeding to the next drilling job.

ORGANIZATIONS

There are at least 70,000 union members in the Canadian mining industry. The union concerned with the mining of coal is the United Mine Workers of America. The International Union of Mine, Mill and Smelter Workers and the United Steelworkers of America are two organizations responsible for the organizing of workers in the metal mining industry. The National Federation of Mining Industry Employees, Inc., an affiliate of the Confederation of National Trade Unions, draws its membership from the mines of Quebec, particularly asbestos mines. Other unions are active throughout the industry on a local basis.

EMPLOYMENT OUTLOOK

Despite the size of the country and the abundance of natural resources, Canada's population — and hence the home market for raw materials — is relatively small. The industry must therefore rely on its ability to export raw and semi-processed materials.

The rapid expansion which took place in the mining industry in the postwar period tended to slow down in the latter part of the 1950's. The present period is one of slower growth, although in the early years of the 1960's some sectors of the mining economy have been experiencing increasing growth rates.

Since mineral production is essentially an export business, it is sensitive to conditions prevailing in the major mineral importing nations at any particular time. In 1961, for example, the United States of America, our single largest customer, experienced less economic growth than in previous years. What might have become surplus production in some sectors of the Canadian mining industry, however, was taken up by the booming economies of Europe and the Far East. Notwithstanding the general soundness and well-being of the Canadian mineral industry, there are some segments affected by a world oversupply of mineral products.

Nevertheless, the mining industry is making great strides in diversifying its output, in developing new methods of exploration, recovery and utilization, and is looking forward to the eventual strengthening of the mineral markets.

With these points in mind, it can therefore be expected that the future employment outlook will be favourable. It will be characterized by sudden bursts of activity such as when a new process or a new use is discovered for an existing mineral. Most segments of the industry will continue to offer good opportunities for physically and mentally fit young men to reach the status and pay scale of skilled workers within a relatively short time.

SEEKING EMPLOYMENT

Those seeking employment in the mining industry are advised to apply to a National Employment Service office in order to become acquainted with local, regional or national employment opportunities. Applications are also accepted directly at the offices of mine, mill and smelter companies; many large companies have employment officers who look after such applications. General information on employment prospects may also be obtained from provincial Departments of Mines.

EARNINGS

Miner's wages vary considerably according to the location of the mine, the specific work performed and the demand of the mineral. Men employed underground are normally paid a production bonus in addition to basic pay. Mine workers may be paid by the day, the week, the month or by contract — basic rates guaranteed in the event of any contract.

Oil workers are among the highest paid wage earners in the country. This is partly because the work is hazardous and partly because working conditions are difficult. A new entrant would start at about $80 per week; drillers earn about $125 weekly. Fringe benefits such as group insurance, vacations with pay or overtime allowances are available but will vary from employer to employer.

Included at the end of the booklet are tables showing standard hours per week and the average hourly earnings for selected mine workers. These are extracted from the 1962 edition of the Department of Labour publication WAGE RATES, SALARIES AND HOURS OF LABOUR issued annually.

Due to the different methods of reporting pay scales, the figures given in the following tables are approximate only and are included for general guidance. Pay scales frequently change, are subject to geographical differences and vary with the degree of responsibility. The reader should refer to the National Employment Service, local employers, union officials, newspaper advertisements or the latest edition of government publications such as Wage Rates, Salaries and Hours of Labour in Canada, *Department of Labour, Canada, for current rates in a particular area or occupation.*

OCCUPATION	PREDOMINANT RANGE — PER DAY NOVA SCOTIA	ALBERTA
TIME WORK	$	$
Underground Workers		
Fire Boss	12.50 — 14.32	17.75 — 18.96
Hoistman	11.90 average	—
Labourer	11.84 — 12.00	15.63 — 15.74
Loader and Mucker	14.90 average	15.07 — 15.63
Miner, Datal	12.40 — 15.76	15.74 — 16.67
Miner (Machine Cutter; Driller; Loader), Datal	16.61 average	16.67 — 17.72
Motorman (Haulage Engineer)	14.25 average	15.52 — 15.68
Rope Rider and Brakeman	11.30 — 12.47	—
Timberman	12.10 — 13.46	15.95 — 16.67
Surface Workers		
Hoistman	11.68 — 13.34	15.32 average
Labourer	12.00 — 13.21	15.01 average
Screenman	11.30 — 12.27	14.79 — 15.68
Surface and Underground Workers		
Blacksmith	13.40 average	15.96 average
Carpenter	12.55 — 13.89	—
Electrician	12.96 — 15.69	15,82 average
Mechanic	12.81 — 14.25	15.24 — 17.68
Welder	13.39 — 14.48	16.05 average
Machinist	13.12 — 15.64	—
Pipefitter	12.56 — 13.56	—
Standard Hours Per Day Average	8	8
PIECE OR INCENTIVE WORK		
Underground Workers		
Fire Boss	15.44 average	—
Miner, Contract	18.81 — 24.83	21.85 — 25.00
Miner, Datal	13.91 — 20.30	—
Miner (Machine Cutter; Driller; Loader), Contract	18.80 — 19.80	—
Roperider and Brakeman	12.74 — 13.27	—
Timberman	13.10 — 14.46	—
Motorman (Haulage Engineer)	13.00 — 14.11	—
Miner (Machine Cutter; Driller; Loader), Datal	16.24 — 20.36	—
Surface Workers		
Hoistman	13.10 — 14.27	—
Screenman	12.66 — 13.15	—
Surface and Underground Workers		
Blacksmith	13.31 — 15.64	—
Standard Hours Per Day Average	8	8

Table 1—Standard Wage Rates for Selected Workers — Coal Mining (Does not include open-pit mining)

OCCUPATION	PREDOMINANT RANGE — PER HOUR QUEBEC	ONTARIO	BRITISH COLUMBIA
	$	$	$
Underground Workers			
Cage and Skiptender	1.40 — 1.59	1.41 — 1.67	—
Chute Blaster	—	1.44 — 1.57	—
Deckman	1.25 — 1.48	1.41 — 1.59	—
Hoistman	1.43 — 1.69	1.55 — 1.85	—
Labourer	1.27 — 1.48	1.32 — 1.46	—
Miner	1.37 — 1.48	1.44 — 1.67	1.85 — 1.95
Miner's Helper	1.32 — 1.43	1.32 — 1.56	—
Motorman (Motor Operator)	1.40 — 1.48	1.42 — 1.56	—
Mucking-machine Operator	1.25 — 1.48	1.40 — 1.59	—
Mucker and Trammer (Shoveller)	1.15 — 1.42	1.28 — 1.61	1.66 — 1.73
Timberman (Shaft Timberman)	1.41 — 1.51	1.42 — 1.70	1.85 — 1.95
Trackman	1.41 — 1.49	1.44 — 1.59	—
Surface and Mill Workers			
Carpenter, Maintenance	1.45 — 1.65	1.50 — 1.84	—
Crusher Operator (Crusherman)	1.35 — 1.49	1.35 — 1.66	—
Electrician, Maintenance	1.53 — 1.70	1.55 — 1.84	—
Labourer	1.17 — 1.33	1.27 — 1.43	—
Machinist, Maintenance	1.46 — 1.65	1.53 — 1.84	—
Mechanic, Maintenance	1.44 — 1.65	1.50 — 1.84	—
Millman (includes Filter Operator, Grinding-mill Operator and Solution Man)	1.34 — 1.65	1.42 — 1.81	—
Steel Sharpener (Bit Grinder; Bit Sharpener)	1.35 — 1.52	1.46 — 1.74	—
Tradesman's Helper	—	1.40 — 1.57	—
Driver, Heavy Truck	—	1.44 — 1.69	—
Standard Hours Per Week Average	44.3	44.2	41.2

Table 2—Standard Wage Rates for Selected Workers—
Gold Mining (Does not include alluvial gold or
copper-silver-gold mining)

OCCUPATION	PREDOMINANT RANGE — PER HOUR NEW-FOUNDLAND	QUEBEC	ONTARIO	BRITISH COLUMBIA
	$	$	$	$
Open Pit Workers				
Blaster	—	2.12 — 2.69	2.48 — 2.66	—
Bulldozer Operator	1.70 — 2.69	2.14 — 2.77	2.48 — 2.54	—
Driller, Machine	1.60 — 2.76	2.12 — 2.76	2.60 — 2.80	2.37 — 2.42
Oiler	—	1.98 — 2.41	2.30 — 2.49	—
Shovel Operator, Power	1.70 — 3.17	2.50 — 3.17	2.72 — 3.12	2.84 — 2.91
Surface and Mill Workers				
Grinding Mill Operator	—	—	2.49 — 2.66	1.96 — 2.34
Hoistman	—	—	2.36 — 2.78	—
Mechanic, Diesel	1.60 — 2.90	2.42 — 3.03	2.78 — 2.85	—
Carpenter, Maintenance ..	2.09 — 2.76	2.62 — 2.90	2.72 — 2.93	2.42 (average)
Crusher Operator	—	1.98 — 2.76	2.42 — 2.60	1.84 — 2.44
Electrician, Maintenance ..	—	2.53 — 3.10	2.72 — 2.97	2.41 (average)
Labourer	1.65 — 2.14	2.13 — 2.27	2.06 — 2.24	1.74 — 2.09
Machinist, Maintenance ..	—	2.53 — 3.10	2.90 — 3.12	—
Mechanic	—	2.42 — 2.96	2.66 — 2.91	2.30 — 2.59
Tradesman's Helper	1.77 — 2.34	1.98 — 2.42	2.30 — 2.49	—
Welder, Maintenance ..	2.05 — 2.83	2.31 — 2.97	2.78 — 2.99	2.30 — 2.59
Underground Workers				
Labourer	—	—	—	—
Miner	2.78 — 2.84	—	—	—
Miner's Helper ..	—	—	—	—
Standard Hours Per Week Average		40	41	
Weekly range	40 — 48			40 — 44

Table 3—Standard Wage Rates for Selected Workers—
Iron Mining

OCCUPATION	NEW-FOUNDLAND	QUEBEC	ONTARIO	BRITISH COLUMBIA
	PREDOMINANT RANGE — PER HOUR			
	$	$	$	$
Underground Workers				
Cage and Skiptender	1.50 — 1.79	1.51 — 2.40	2.00 — 2.45	1.98 — 2.18
Chute Blaster	—	1.59 — 2.16	2.34 — 2.44	2.04 — 2.06
Deckman	—	1.44 — 2.06	1.45 — 2.33	—
Hoistman	1.75 — 1.90	1.72 — 2.49	2.07 — 2.65	2.07 — 2.41
Labourer	1.25 — 1.37	1.41 — 2.05	2.10 — 2.20	1.68 — 1.94
Miner	1.62 — 1.79	1.55 — 2.16	2.04 — 2.34	2.00 — 2.41
Miner's Helper ..	1.35 — 1.66	1.47 — 1.95	1.73 — 1.99	1.68 — 1.84
Motorman (Motor Operator)	1.50 — 1.73	1.27 — 2.07	2.27 — 2.34	1.88 — 2.27
Mucking-machine Operator	1.50 — 1.62	1.51 — 2.16	2.23 — 2.47	1.90 — 2.02
Mucker and Trammer (Shoveller)	—	1.51 — 2.07	—	1.68 — 2.20
Timberman (Shaft Timberman) ..	1.50 — 1.87	1.59 — 2.34	2.34 — 2.35	2.17 — 2.41
Trackman		1.59 — 2.22	2.33 — 2.34	1.94 — 2.13
Surface and Mill Workers				
Blacksmith	1.78 (aver.)	1.67 — 2.30	2.53 — 2.65	2.17 — 2.55
Carpenter, Maintenance ..	1.50 — 1.83	1.47 — 2.20	2.20 — 2.75	2.08 — 2.55
Crusher Operator	1.50 — 1.71	1.49 — 2.20	2.20 — 2.44	1.85 — 2.20
Electrician, Maintenance ..	1.62 — 1.87	1.67 — 2.33	2.53 — 2.82	2.08 — 2.62
Filter Operator ..	—	1.41 — 2.02	1.92 — 2.58	1.90 — 2.13
Flotation Operator	1.77 (aver.)	1.51 — 2.22	1.71 — 2.46	2.00 — 2.41
Grinding-mill Operator	1.65 (aver.)	1.40 — 2.19	1.50 — 2.58	1.85 — 2.20
Labourer	1.15 — 1.52	1.34 — 1.78	1.85 — 2.06	1.69 — 1.92
Machinist, Maintenance ..	1.79 — 2.12	1.70 — 2.37	2.53 — 2.75	2.11 — 2.55
Mechanic, Maintenance ..	1.62 — 1.87	1.60 — 2.33	2.20 — 2.82	2.10 — 2.48
Solution Man	—	1.47 — 2.02	2.05 — 2.68	—
Steel Sharpener (Bit Grinder) ..	—	1.65 — 2.24	1.90 — 2.41	1.90 — 2.27
Trademan's Helper	1.35 — 1.65	1.45 — 1.98	1.99 — 2.20	1.84 — 1.99
Welder, Maintenance ..	1.65 — 1.87	1.59 — 2.33	2.53 — 2.82	2.09 — 2.55
Standard Hours Per Week				
Average	45.8	41.3	40.3	40.4
Range	44 — 48	40 — 44	—	40 — 42

Table 4—Standard Wage Rates for Selected Workers—
Metal Mining (Does not include gold and iron)

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DEPARTMENT OF MINERAL RESOURCES —
Government of Saskatchewan

DEPARTMENT OF MINES AND NATURAL RESOURCES —
Government of Manitoba

DEPARTMENT OF MINES — Government of Ontario

DEPARTMENT OF LAND AND MINES —
Government of New Brunswick

DEPARTMENT OF MINES — Government of Nova Scotia

DEPARTMENT OF MINES, AGRICULTURE AND RESOURCES —
Government of Newfoundland

DEPARTMENT OF MINES AND TECHNICAL SURVEYS —
Government of Canada

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Port Arthur, Ontario

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ONTARIO MINING ASSOCIATION

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HIGH AND VOCATIONAL SCHOOL — Timmins, Ontario

TECHNICAL AND VOCATIONAL TRAINING BRANCH —
Federal Department of Labour

THE CANADIAN INSTITUTE OF MINING AND METALLURGY

THE CONSOLIDATED MINING AND SMELTING COMPANY OF CANADA LIMITED

UNITED STEEL WORKERS OF AMERICA

VOCATIONAL EDUCATION DIVISION —
Provincial Department of Education, Nova Scotia

CANADIAN OCCUPATIONS FILMSTRIPS

The Department of Labour has prepared, to date, the following occupational filmstrips in collaboration with the National Film Board. A manual has been prepared as an accompaniment to each filmstrip. These may be purchased from the National Film Board, Box 6100, Montreal, or from any one of its regional offices. Prices in Canada: $4.00 for colour; $2.00 for black and white.

Bricklayer and Stone-Mason

Plumber, Pipefitter and Steamfitter

Sheet-Metal Worker

Machine Shop Occupations

Printing Trades

Motor Vehicle Mechanic

The Social Worker

Mining Occupations

Electrical and Electronic Occupations (in colour)

Careers in Engineering (in colour)

Careers in Natural Science (in colour)

Draughtsman

Careers in Home Economics

Careers in Construction

Medical Laboratory Technologist (in colour)

Careers in Meteorology

Teacher (in colour)

Office Occupations (in colour)

Electronic Computer Occupations (in colour)

Careers in Library Service (in colour)

MINING OCCUPATIONS
Monograph No. 14

CANADIAN OCCUPATIONS

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FOUNDRY WORKERS

★

MONOGRAPH 15

DEPARTMENT OF LABOUR, OTTAWA

C A N A D I A N   O C C U P A T I O N S

★

FOUNDRY WORKERS

MONOGRAPH 15

HON. MILTON F. GREGG, V.C., MINISTER
ARTHUR MACNAMARA, C.M.G., LL.D., DEPUTY MINISTER

DEPARTMENT OF LABOUR, OTTAWA

FOREWORD

During recent years there has been a steadily increasing demand for up-to-date information on occupations.

This demand comes from youth faced with the need of choosing an occupation and of selecting the type of training required; from parents, teachers and other counsellors; from workers shifting to other occupations; from employment service officers; from directors of personnel and union officials, and from other quarters.

This series of monographs and an accompanying series of pamphlets, the latter containing similar information in a condensed form, are attempts to meet this demand.

These publications represent an expansion of an earlier series issued by the Department of Veterans Affairs to assist members of the armed forces returning to civilian life following the end of the war. These current series, designed for general use, cover a wide range of occupations, including professions. They indicate, among other things, the nature of the occupation or group of occupations, entrance and training requirements, working conditions and opportunities in each.

The monographs have been prepared by our research staff working on occupations, with the generous help and advice of officials of the Unemployment Insurance Commission, Vocational Training Branch of the Department of Labour, Dominion Bureau of Statistics, Provincial Departments of Education and of Labour, employers' associations, trade unions, professional associations, and other government and non-government bodies.

Grateful acknowledgment is made of this assistance and that obtained from numerous publications on occupations prepared in Canada and in other countries.

DIRECTOR,
Economics and Research Branch,
Department of Labour.

March, 1951.

FOUNDRY WORKERS

HISTORY AND IMPORTANCE

It is not known when man first produced shaped metallic objects by pouring the molten metal into a mould. Genesis 4:22 tells of Tubal Cain, an instructor of every artificer in brass and iron, and it is recorded in II Chron. V-17 that the temple pillars, brass altar, "molten sea", and other metal objects of complex design for King Solomon's temple were cast "in the clay ground between Succoth and Zeredathah"; whether many works of this nature were produced in ancient times is questionable. It is certain that the casting of metal statues was common practice in Renaissance times, and equally certain that as soon as cannon graduated from leather bombards to solid metal they could have been so made only by casting. The techniques developed in these two instances have since been applied to the production of many metallic objects, especially to that of large and thick ones. New techniques have been invented in modern times.

In Canada the first foundry was established at St. Maurice in 1737. It operated for over a century, even exporting castings, until the ore supply became exhausted. The Normandale Furnace in Central Ontario and the New Glasgow plant in Nova Scotia were nineteenth-century pioneer undertakings producing cast iron and steel.

In 1921, Canada was importing from the United States and Britain about $4,250,000 worth of castings and forgings in excess of her own exports. The first world war had, however, greatly stimulated the metal industries, and domestic demand for agricultural implements had, with the settlement of the Prairies, built up a thriving manufacture of these in Canada. The second world war caused a great expansion in foundry activities, and since its end the production of durable consumer goods, and of agricultural and other machinery, has been on a greatly enlarged scale.

FIELD OF WORK

Basically, the work of a foundry consists in the melting of metal in an appropriate type of furnace, the use of a pattern having the shape and exact dimensions of the required object (with some allowance for shrinkage on cooling), the creation around the pattern of a mould of sand, loam, plaster, wax, or (more recently) plastic material, and the pouring of the metal into the space inside the mould left by the withdrawal of the pattern. The comparatively rough product of this stage is cleaned, smoothed and made perfect by using hand or machine tools. Where hollows exist in the pattern (such as a boring for a shaft) a sand core, made to correspond, is inserted in the mould.

Some moulds may be made of metal having a different melting-point from that of the material which is to be moulded. An example is the use of iron moulds for aluminum castings.

Many foundries do custom or jobbing work, making limited quantities of castings for manufacturers, who often supply the patterns. Others, which do most of the quantity production, form part of an integrated industrial establishment, such as one producing stoves.

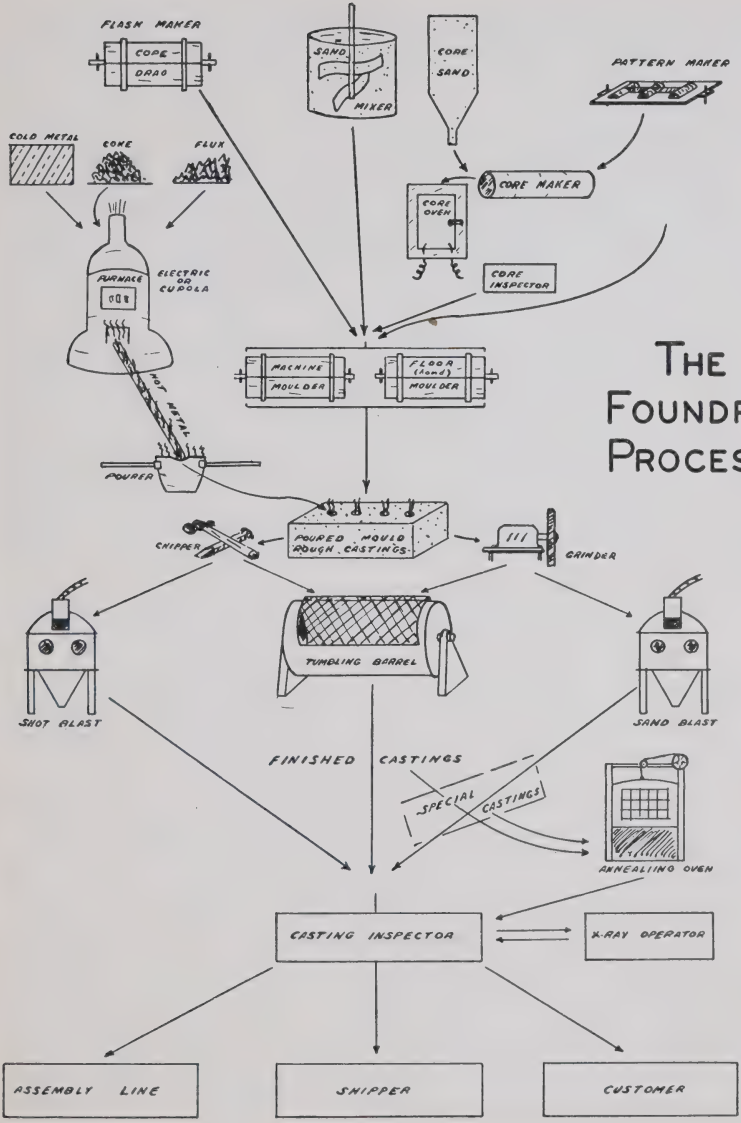
Metals commonly used in foundry processes are malleable iron, cast iron, steel, aluminum, magnesium, nickel, copper, lead, zinc, tin and alloys of these, including brass and bronze. Foundries tend towards specialization in metals cast, largely because of the differing furnace requirements.

Industries operating their own foundries include those producing automobiles, machine tools, farm machinery, industrial machinery, household appliances, plumbing equipment, heating apparatus and aeroplanes.

Inasmuch as the products of such "captive" foundries are not separable from the end product of the industries of which they form part, no data available as to the value or quantity of their production of foundry items.

It should be noted that some metal parts must be forged or rolled, and cannot be cast. Others are moulded, by pressure, from sheets, and cut to shape. Nevertheless,

The Foundry Process



there are few industries manufacturing metallic products which do not employ foundry work in some phase of their processes.

PROCESSES AND OCCUPATIONS

Before any processes are set in motion, two types of professional man, a *foundry chemist* and a *metallurgist*, may be concerned in the establishing of the qualities and properties of the metal to be used in specific castings. These professions, dealt with in our booklet "Careers in Natural Science and Engineering", will not be further mentioned in this monograph. In some cases a metallurgist is consulted, and is not a member of the staff.

The metal is melted in the appropriate one of the following types of furnace: Electric-arc; reverberatory; air; cupola or open-hearth; tilting and crucible. Before pouring, each "heat" has added to it a very small quantity of powder (to grey iron, a silicious powder; to some non-ferrous heats, a pinch of lithium metal) to purify the metal.

The *operators* of these *furnaces*, also known as "melters", are skilled men. *Furnace helpers* assist them.

Patterns are prepared by *pattern-makers*, highly skilled workers. Patterns may be of wood or of metal or even plaster, and are slightly larger than the desired casting, to allow for shrinkage on cooling.

For all but very large patterns, a "flask"—a metal or wooden container in two sections, without top or bottom—is used. This is made by a *flask maker* if of metal; if of wood it may be made by a *carpenter*. Into the lower half or "drag" of this is inserted the pattern. A *moulder* then packs tightly around the pattern wet or otherwise bonded sand or loam. He then places the upper half or "cope" of the flask in position, and packs this in the same manner. The cope of the flask is then removed, containing the "cope" of the mould; the pattern is lifted out; in it channels have been made to permit proper distribution of the molten metal. If there is a "core" this is inserted

in spaces in the mould provided by the core prints built into the pattern. Any faults in the mould may be corrected with hand tools, and the sand may be faced with graphite. Feeding and ventilating passages known as "gates" and "risers" or "sprues", made by wooden pegs and cleared by air blast, are left to receive the flow of metal and permit the escape of air and gases, the sections of the mould are joined, and the metal poured in by a skilled *pourer* or *ladle man*. When the casting becomes solid, the mould is removed. The oil in the cores burns, and the sand falls out.

The moulder may work at a bench or with a moulding machine for light jobs, or on the floor for heavy ones. Some floor jobs have no flask, and in some cases rods and nails of metal must be used to reinforce the mould. The moulding machine is used for quantity production.

Cores are made by skilled workers known as *core-makers*. The skill required varies, since some cores are easy to make. Sand bound with linseed oil is forced into a core-box, simply a hollow pattern of wood or metal, often in two sections. Small repetitive jobs are done by machines using compressed air, with a multiple core-box. A tap on the base of the box shakes out the cores, which, after inspection by a *core inspector*, are then baked in an electric oven. Small cores are baked quickly, larger ones are given longer treatment at lower temperatures. The making of complex cores requires great skill; some must be in sections which are pasted together. Simple cores require little skill when made by machine.

The rough casting is now handled by *chippers* and *grinders*—the former remove excrescences by using hand or mechanically operated chisels, hammers, shears or saws. The grinder uses an abrasive wheel. The object is then placed in a tumbling barrel, a revolving drum, to remove rough surfaces; sometimes a sand-blast, or blast with iron filings or steel shot, process is used. The *tumbling barrel operator* is a semi-skilled man; so is the *sand-blaster*. Final surface treatment is sometimes given by the use of grinding wheels, sometimes moving over a whole surface such as a stove top, in a special machine.

The casting may be *heat-treated* or annealed by an *annealer*, according to the kind of metal and the physical requirements of its function.

A *casting inspector* checks the finished job for dimensions and surface finish.

The internal structure may be examined by an *X-ray technician*.

Another technician is the *sand-control man*, who sees to the quality and constituent proportions of the sand or other material used to make the moulds and cores. Special testing equipment is used for this purpose, especially for machine moulding, in many foundries.

A number of *moulder's helpers* may be employed in parts of the moulding process; some of these may be apprentices. *Coremaker's helpers* and *pourer's helpers* are employed in larger foundries. *Sand mixers* perform their duties by hand, or using a machine. Some castings may be treated by *annealers*, others by *galvanizers*. *Welders* (acetylene, arc, aluminum, atomic or combination) may be employed, as may *flame cutters*, in certain foundries. Heavy moulding jobs necessitate the services of *derrick* or *crane operators*.

In a large foundry much of the conveying is done by suspension of the articles from pulleys running on overhead monorails. Such apparatus may be used for conveying pots of molten metal, for feeding furnaces, or to guide cores into ovens, as well as lifting castings.

DUTIES

The following are, in operational order, the duties of the principal *production* workers in a foundry, in fuller detail.

PATTERN-MAKER, WOOD

Builds wooden patterns to be used by Moulder in making moulds; shapes parts of pattern from wood, using hand tools and woodworking machines, following blueprints; assembles pattern parts with screws or nails; covers finished pattern with shellac or varnish, sometimes

Photo N.F.B.

Propellors into Iron-Stands

using different colours to indicate core prints or type of metal to be used. If casting blueprint specifies internal hollows, shapes core boxes to be used by Coremaker in making cores as facsimiles of required internal hollows. May mount and prepare patterns for Machine Moulder.

PATTERN-MAKER, METAL

Prepares metal pattern, roughly cast from wood pattern, for use of Moulder in making moulds; using metal-working machines, shapes the metal pattern into its exact dimensions according to blueprint specifications; finishes pattern by scraping, filing, and polishing; checks finished pattern with precision measuring instruments to ensure conformity to blueprint specifications.

CUPOLA CHARGER

Shovels by hand or operates charging machine to feed correct proportions of scrap or pig iron, coke and flux (limestone) into cupola: under Cupola Tender's direction, weighs charges of coke, iron and limestone; transports charges in wheelbarrow, truck, or small rail car to charging door; shovels or dumps charges into cupola, as directed by Cupola Tender, until end of heat. May assist Cupola Tender in clearing away residue below cupola, and in repairing cupola lining.

CUPOLA TENDER (Cupola Operator; Furnaceman; Melter)

Operates a cupola furnace to melt scrap or pig iron, combined with coke and limestone, to produce molten iron for casting: patches with fireclay walls and bottom, breast and spout, before lighting fire; supervises charging of cupola with necessary coke and iron layers by Cupola Charger; turns on air blast, and when the level of molten iron is high enough, taps furnace by poking out plug (bott) in spout (tap hole), allowing iron to flow into ladles until end of heat; opens cupola bottom to remove slag and coke. May help Cupola Charger in small foundries. May repair cupola wall and bottom by laying new refractory bricks, or may supervise helpers in these tasks.

ELECTRIC-ARC FURNACE OPERATOR

Operates, by means of electric switches, rheostats, voltmeter, ammeter, and mechanical levers, an electric-arc furnace for melting and pouring metals. Tilts furnace by geared hand-wheel to receive charge of metal. Charges metal into furnace. Returns furnace to operating position. Throws switch to apply current. Moves electrodes to start arc. Watches ammeter and voltmeter and moves rheostat control to maintain proper current and voltage. May remove samples and cast them into test bars for metallurgists. Shuts off current and pours molten metal into ladles and moulds, tilting furnace.

SAND CUTTER (Sand Mixer)

Prepares mixtures of sand, water, and binder material, as prescribed by the Sand-Control Man, the Sand Tester, or the Moulder, for making moulds and cores: may use hand shovel to mix small quantities of sand, adding water and binder to obtain proper quality and consistency; may test sand by crumbling samples in his hand. (Most mixing is done by machine.) May operate an electrically driven sand cutter to mix new and old sand.

BENCH MOULDER (Hand Moulder)

Forms sand moulds on bench for production of small castings: packs sand around a pattern in flask, using hand rammer and riddle (sieve); vents mould and provides channels for pouring molten metal into mould, by piercing cope (top half) with gate and riser sticks; withdraws pattern; for hollow castings, sets cores in core prints (grooves) in mould or on supports, (chaplets), which become embedded in castings; repairs and finishes mould surface, brushing a facing material such as graphite over it to give casting a smooth finish; lifts cope back onto drag (bottom half) and closes mould with clamps; places it on floor for pouring. May carry metal from furnace in hand ladle and pour it into moulds.

FLOOR MOULDER

Constructs large sand moulds on foundry floor for production of large castings: with the floor as base for bottom half of flask, rams sand around pattern using a pneumatic rammer or sand-slinger machine; fits cope (top half of flask) on bottom half after finishing joint; rams sand into cope; cuts runners and vents in mould with gate sticks, riser sticks and wire; repairs and finishes mould surface, brushing facing material over it and reinforcing it by pushing nails or "chills" into it; sets cores in core print grooves or anchors them with chaplets (metal supports); directs Crane Operator in replacing cope on the bottom of flask. May pour metal into the mould.

MACHINE MOULDER

Operates any of several types of moulding machines, manually or power driven, to produce large quantities of identical moulds: assembles flask sections; positions pattern in flask; fills flask compactly with sand either manually or using jarring, jolting, or squeeze machine; controls machine for withdrawing pattern by roll, turnover or stripping-plate methods. May pour metal into finished moulds.

COREMAKER

Forms core as a facsimile of desired interior shape of hollow casting: fills core box, with special sand; rams, vents, and reinforces core with steel wires (gaggers); turns

Photo N.F.B.

Pouring Number Plates

core box over, to dump core on core plate for transfer to baking oven. (In green sand moulding, cores are not baked but used damp in the moulds.) Uses sectional core boxes for complicated cores. May operate conveyor-screw machine or core blower to produce simple cores shaped by suitable dies, or in producing more complex cores, may use core-turn-over-draw machine to eliminate hand ramming and withdrawing of cores from boxes.

LADLEMAN (Metal Pourer)

Pours molten metal into sand moulds to produce castings: carries metal in long-handled (shank) ladles from furnace to small moulds; fills moulds by tilting the ladle and pouring metal over lip into moulds; or works in a team to transport metal from furnace to larger moulds in buggy ladles or bull ladles, lip-pouring as for small moulds.

BURNER (Cutter)

Cuts away excess metal and undesired projections from ferrous castings, using oxyacetylene or special flame-cutting equipment. May manually turn and lift large castings. May mark and follow lines from a blueprint for precise trimming.

CHIPPER AND GRINDER (Cleaner)

Removes excess metal from castings using hand or pneumatic hammers, chisels, and grinding wheels (stationary, swing or portable). May chip or grind to a line drawn by Inspector on castings, and smooth rough spots with a file. May be known as Chipper when performing chipping tasks only, or as Grinder when limited to grinding work.

WHEELABRATOR OPERATOR

Operates a machine, Wheelabrator, to clean castings of sand and rough surfaces by the abrasive action of steel shot: places castings on platform in shot blast cabinet, or on a roller conveyor; manipulates controls

to start the shot blast mechanism, the platform revolving or the conveyor moving through the shot blast cabinet; removes cleaned castings from machine, placing them on truck or conveyor for next operation.

SAND BLASTER

Removes scale and sand from surfaces of castings: directs blast of compressed air mixed with abrasive sand, steel shot or grit, at castings, in an enclosed room, using a special nozzle, mixer, and air hose. May transport castings, after blasting, to inspection and shipping department.

INSPECTOR

Examines all castings, rejecting those which are cracked or otherwise defective, and measures castings for conformance with blueprint specifications, marking excess metal for removal by Chipper or Grinder. May indicate salvage method for partially defective castings.

ANNEALER (Annealing-Furnace Operator)

Fires and regulates an annealing furnace to improve properties of castings: loads castings into furnace by hand, conveyor system, crane, or electric truck; lights furnace burners; regulates heat treatment by watching furnace pyrometer in order to maintain correct temperature during period specified; allows oven to cool slowly before removing castings.

Maintenance workers include the following journeymen, who perform the duties proper to their trades: Blacksmith, Electrician, Machinist, Carpenter.

Clerical workers include bookkeepers, general clerks, office appliance operators, stock record clerks.

Labourers may be employed in any phase of the work requiring manual duties only, with a short learning period, involving little or no independent judgment.

QUALIFICATIONS

Inasmuch as heavy muscular work may be incidental to any foundry job in production, a young man entering into this industry must have good physique, and be sound in limb and agile. Since heat and fumes are unavoidable in many phases of the work, there should be no tendency to any bronchial or pulmonary weakness.

There is no set age limit for employment, but if one of the skilled trades is aimed at, the entrant is unlikely to be accepted if over 20.

Educational standards are not, as a rule, rigid, but the youth with some secondary or technical school education is at a considerable advantage over those lacking this. Some large firms which have formal apprenticeship schemes require grade XI standing.

The worker in this industry needs to be alert, able to understand orders and carry them out quickly, and able to co-operate with fellow-workers as a member of a team. He requires some measure of judgment, and must always consider his own safety and that of others in carrying out his duties.

TRAINING

A few apprentices are formally indentured to moulding and pattern-making, mostly in British Columbia. Otherwise, training is on the job. In the skilled trades it varies locally from two to four years.

ENTRY

Except in the case of a few very large firms, applicants go direct to the foundry, or are sent by the National Employment Service. Some of the largest engineering firms, which have regular apprenticeship schemes for the skilled trades of pattern-maker, moulder, and coremaker, may prefer youths introduced by their own employees or by business contacts. The National Employment Service is in a position to advise would-be entrants as to the best procedure.

EARNINGS

The following rates of pay for selected occupations in the Iron Castings group of this industry may be regarded as an index to the wage levels of the industry as a whole. Since these data were compiled, there have been upward changes in living costs and in the hourly wage rates of heavy industry generally.

IRON CASTINGS, WAGE RATES (hourly) AS AT 1 OCTOBER, 1949

Occupation	Locality	Average	Range
Chippers and Grinders	Canada	$1.04	$ —
	Quebec	1.08	.75—1.31
	Montreal	1.18	1.02—1.32
	Ontario	1.04	.80—1.34
	Toronto	1.07	.91—1.20
	Manitoba	.87	.79— .99
	Alberta	.94	.90—1.00
	British Columbia	1.22	1.21—1.23
Coremakers	Canada	1.18	—
	Quebec	1.12	.81—1.48
	Montreal	1.34	1.21—1.48
	Ontario	1.19	.91—1.50
	Toronto	1.19	1.08—1.37
	Manitoba	1.13	.85—1.44
	Alberta	1.08	.90—1.25
	British Columbia	1.39	1.38—1.44
Labourers	Canada	.93	—
	Nova Scotia	.77	—
	Quebec	.77	.63— .95
	Montreal	.86	.70— .95
	Ontario	.97	.80—1.08
	Toronto	.97	.94—1.05
	Manitoba	.93	.77—1.03
	Alberta	.91	—
	British Columbia	1.15	.95—1.13
Machinists	Canada	1.10	—
	Quebec	1.07	.85—1.20
	Montreal	1.18	1.14—1.25
	Ontario	1.11	.93—1.27
	Toronto	1.16	1.10—1.20
	Alberta	1.17	1.00—1.25
	British Columbia	1.39	—
Machinists' Helpers	Canada	.98	—
	Manitoba	.98	.92—1.04

IRON CASTINGS, WAGE RATES (hourly) AS AT 1 OCTOBER, 1949 (Continued)

Occupation	Locality	Average	Range
Moulders	Canada	$1.25	$ —
	Nova Scotia	1.05	.90—1.10
	New Brunswick	.82	.70— .95
	Quebec	1.07	.85—1.27
	Montreal	1.27	1.19—1.52
	Ontario	1.29	.98—1.63
	Toronto	1.28	1.08—1.62
	Manitoba	1.33	.97—1.67
	Alberta	1.10	1.00—1.25
	British Columbia	1.37	—
Moulders' Helpers	Canada	.89	—
	Nova Scotia	.84	—
	Quebec	.82	.70— .99
	Ontario	.96	.80—1.08
Pattern-makers	Canada	1.24	—
	Quebec	1.20	.97—1.38
	Montreal	1.31	1.18—1.38
	Ontario	1.26	1.04—1.54
	Toronto	1.18	1.05—1.35
	Manitoba	1.12	1.03—1.18
	Alberta	1.20	—
	British Columbia	1.54	1.54—1.57

Average hours per week in this branch of the industry were, on the above date, as follows:

Locality	Average	Range
Canada	44.8	—
Nova Scotia	44.0	—
New Brunswick	50.2	44—53
Quebec	46.7	40—59
Ontario	44.4	40—49
Manitoba	43.0	40—45
Saskatchewan	44.0	—
Alberta	40.8	40—44
British Columbia	40.0	—

They may be regarded as indicative of normal hours in the industry as a whole, though some shops integrated with large establishments will follow the practice of the major industry.

ADVANCEMENT

The line of advancement in this industry is approximately: Pattern-maker's apprentice, to Pattern-maker, to Foreman Pattern-maker (in large establishments); Cupola Tender or Furnace Tender to Cupola Operator or Furnace Operator; Apprentice Moulder or Moulder's Helper to Moulder, to Foreman Moulder; Apprentice Coremaker or Coremaker's Helper to Coremaker, to Foreman Coremaker; Ladleman's or Pourer's Helper to Ladleman or Pourer.

The occupations of Burner or Cutter, Chipper and Grinder, Wheelabrator Operator, Sand Blaster, and similar finishing workers, may lead to that of Inspector.

Foremen may become Shop Superintendents in larger plants.

The variation in size and nature of operation of foundry plants makes any generalization on lines of promotion impossible. Many men who start in labouring-type jobs may graduate to semi-skilled work, and from that to skilled employment, since apprenticeship is not generally formal, where it does exist, except in very large plants.

RELATED OCCUPATIONS

The trade of the pattern-maker in foundry work is more or less related to that of pattern-makers in any industry, according to the amount of skill involved in these latter.

That of furnace operators is akin to that of operators of furnaces in rolling mills and in metal refineries.

There is some relation between the skills of a machine moulder and of moulders of ceramic products.

The work of the chipper and grinder is closely parallel to that of the operator of grinding machines in any industry.

That of the burner or cutter is similar to that of welders and flame cutters in any industry.

Annealers or heat treaters are common to many metal industries.

Coremakers are peculiar to foundry work.

The various helpers and labourers, and operators of machines requiring no particular skill, can be regarded as transferable to any heavy industry.

ADVANTAGES AND DISADVANTAGES

The skilled workers in this industry are in demand in times of general industrial activity.

Pay is comparable, for all grades of workers, to that for equal grades of skill in heavy industry generally.

The workers are well organized.

Unemployment Insurance and Workmen's Compensation apply to this industry.

In the cases of the more skilled men, such as patternmakers, coremakers and moulders, there is variety of work and the satisfaction which results from a knowledge of a personal share in a good product.

Working conditions in larger establishments have been much improved in recent years.

In all establishments, however, there are of necessity areas where abnormal heat must be undergone. In less modern shops there may be danger for the careless in the wide distribution of hot metal in various stages of the foundry process, necessitating cautious movement. There is also danger from careless pouring, from improperly vented moulds, and other results of human fallibility. Accidents and injuries are, however, infrequent.

Noise is not a serious factor in most foundries.

It is not possible, in view of the wide and varied distribution of foundry work, to generalize about hours, pension schemes, and vacations with pay. It may be said that in large industries having "captive" foundries the foundry workers will share, where they are members of an industrial union, in such benefits as are in the general union contract.

ORGANIZATIONS

In most very large metal-working industries such as automobile, aircraft, and heating apparatus, embodying

a foundry shop the workers will be members, as above suggested, of the industrial union under contract with management.

Many smaller shops, and a few larger ones, are organized by the International Moulders and Foundry Workers Union of North America. This applies especially to independent foundries doing custom work.

In some large cities pattern-makers have a separate craft union.

TRENDS

Foundry operations are so closely related to the expansion of heavy industry in Canada, and are integrated to such an extent with the production processes of large manufacturers of metal objects that no statistical information on total foundry production or total foundry employment is obtainable. Such partial data as are available are given below.

Number in Occupations

Until the 1951 census figures are available, it will not be possible to estimate the number of persons engaged in the trades peculiar to foundry work—pattern-makers, moulders, and coremakers.

The figures for 1941, as extracted from census records, indicate that at that time there was the following distribution in the "Iron and its Products" group of industries.

(See Table in following page)

FOUNDRY AND RELATED OCCUPATIONS — IRON AND ITS PRODUCTS, 1941

Industry	Total	Furnace-men	Heat-treaters and Annealers	Moulders Core-makers Casters	Pattern-makers
Aircraft	219	24	33	65	97
Automobiles and Cycles	876	108	119	585	64
Boilers, Engines, Machinery, n.e.s.	660	43	13	453	151
Farm Machinery and Implements	480	21	—	388	71
Firearms and Guns	50	11	—	29	10
Foundry Products	7,011	734	54	5,774	449
Hardware and Tools	289	29	51	184	25
Munitions	398	65	28	272	33
Primary Iron(1)	2,770	1,229	79	1,330	132
Railway Rolling Stock, Repair	260	37	—	168	55
Sheet-Metal Products	210	63	—	108	39
Shells and Bombs	98	45	—	53	—
Shipbuilding and Repair	172	19	21	58	74
Tanks and Carriers	22	—	—	22	—
Wire and Products	42	13	10	19	—
Other Iron Products	204	28	—	133	43
Totals	13,761	2,469	408	9,641	1,243

(1) Few of the "furnacemen" would be concerned with Foundry operations. Many of the "moulders" and "casters" would be casting simple billets and other primary forms of iron and steel.

The total number of persons listed under strictly "Foundry Products" is as follows:

Male.............. 30,568 Female............. 1,472

Excluding owners and managers, and maintenance men belonging to trades not peculiar to this industry, as well as clerical and service staffs, the following *production* occupations, in addition to those listed in the table above, are noted.

OTHER PRODUCTION EMPLOYEES, FOUNDRY PRODUCTS, (IRON AND STEEL) 1941

	Male	Female	Total
Foremen	734	7	741
Inspectors and Gaugers	414	55	469
Blacksmiths, Hammermen, Forgemen	499	—	499
Boilermakers, Platers, Riveters	252	5	257
Filers and Grinders	411	7	418
Fitters and Assemblers	763	23	786
Machinists	2,179	—	2,179
Millwrights	129	—	129
Sheet-Metal Workers and Tinsmiths	648	7	655
Tool Makers, Die Cutters and Setters	393	—	393
Welders and Flame Cutters	778	10	788
Other Metal Working	3,137	200	3,337
	10,337	314	10,651

A similar analysis of the four key trades in the non-ferrous metal products group follows:

FOUNDRY AND RELATED OCCUPATIONS — NON-FERROUS METALS 1941

Industry	Total	Furnace-men	Heat-treaters and Annealers	Moulders Core-makers Casters	Pattern-makers
Brass and Copper Products	886	101	16	723	46
Electrical Products	231	19	—	175	37
Non-ferrous Smelting and Refining(1)	3,029	2,857	—	159	13
Other Non-ferrous	256	127	11	118	—
	4,402	3,104	27	1,175	96

(1) Here, again, the furnacemen in "Smelting and Refining" cannot be regarded as generally belonging to the foundry group, though some foundry work is done, as indicated by the fact that a small number of pattern-makers are employed.

A few moulders, coremakers and casters, as well as pattern-makers, are employed by steam railways.

Other production employees in non-ferrous metal products manufacturing are:

OTHER PRODUCTION EMPLOYEES — NON-FERROUS METALS 1941

	Brass-Copper	Electrical	Smelting	Other	Total
Foremen	179	650	553	152	1,534
Inspectors and Gaugers	219	1,153	89	134	1,595
Blacksmiths, etc.	18	31	71	14	134
Boilermakers, etc.	13	35	103	—	151
Filers and Grinders	136	76	15	16	243
Fitters and Assemblers	100	423	66	20	609
Machinists	549	1,517	374	161	2,601
Millwrights	54	76	133	24	287
Polishers and Buffers	306	149	18	119	592
Sheet-Metal, etc.	64	278	21	79	442
Tool Makers, etc.	92	426	—	31	549
Welders and Flame Cutters	55	604	200	54	913
Other Metal-Working	—	6,444	2,089	753	9,286

It seems quite obvious that the greater number of foremen, inspectors and gaugers, fitters and assemblers, machinists, millwrights, sheet-metal workers, toolmakers, welders and "other metal-working" employees were not directly associated with the foundry processes in non-ferrous branches of the industry. This would be especially true in the electrical goods field.

In arriving at the totals of the four trades or trade groups more or less peculiar to foundry work, it is necessary to eliminate most of the *furnacemen* shown under "Smelting and Refining". A total for this trade may have been something like:

Iron and products	2,469	less primary iron	1,100
Non-ferrous	3,104	less smelting and refining	2,500
Total	5,573	less	3,600

or approximately 2,000 *furnacemen*.

Heat treaters and *annealers* would have totalled about 400, deduction being made of those in "primary iron".

Moulders, *coremakers* and *casters* as given would include some casting steel billets and pigs of iron. Since

these are not foundry products, the approximate number in foundry work, independent and "captive", may have been:

Iron and products	9,641	less primary iron	1,000
Non-ferrous	1,175	less smelting and refining	100
Railways	25		
Total	10,841	less	1,100

or about 9,700 *moulders, coremakers* and *casters.*

(Separate figures are not available for coremakers and casters.)

Pattern-makers would all have been associated with the casting process, and would have totalled: 1,243 plus 96, or about 1,350, including the few in steam railway shops.

Growth

Since the changes in industry after the war have been very great, and since the metal-working groups are among those showing the greatest expansion, with some contraction in individual industries, no figures which could be estimated now would have any validity. The tables above given may provide some guide to the probabilities, in the light of known changes in production.

In 1946 the Department of Veterans Affairs made a survey covering *Moulders, Coremakers* and *Casters* in a single group. It was estimated that the number then employed was 9,249, and that an additional 1,019 were needed for 1947.

A similar survey on *Pattern-maker* showed totals of 1,067 "wood" and 941 "metal", or 2,008 in all with requirements for 1947 only 134. The increase of practically 50 per cent over the 1941 figure of 1,350 is consistent with the change-over of industry just after the end of the war, since new products would require much more pattern work. The contrast between anticipated demand in this occupation and that for moulders, coremakers and casters reflects the sequence of the foundry process, where new products replaced those of war-time.

There is no doubt that the greatly increased production of durable metallic consumer goods, mostly of a heavy nature involving castings, has added considerably to employment in foundry work since the 1946 figures were compiled.

The increasing demand for armament and munitions, as well as for aircraft and ships, will further call upon the services of this industry.

Employment Outlook

Some indication of the employment situation in this industry may be given by a study of the following figures on Unfilled Vacancies and Unplaced Applicants (Male) at six-month intervals since July 1, 1948. These figures, derived from National Employment Service records, do not give the full picture, since many jobs are filled by direct application.

Region	July 1, 1948		Dec. 30, 1948		June 30, 1949		Dec. 29, 1949		June 29, 1950		Dec. 30, 1950	
	V	A	V	A	V	A	V	A	V	A	V	A
Canada	160	220	50	440	23	587	22	1,103	49	457	119	299
Atlantic	5	10	—	22	—	35	2	40	—	33	—	21
Quebec	10	57	1	183	6	254	4	423	6	194	11	94
Ontario	128	85	44	156	17	200	16	479	42	165	90	116
Prairie	16	7	5	11	—	17	—	79	—	26	13	22
Pacific	1	61	—	68	—	81	—	82	1	39	5	46

"V" = Unfilled Vacancies; "A" = Unplaced Applicants.

An industry dependent on, and in many cases integrated with, a wide variety of other industries, is inevitably affected by the demand for the products of these latter. Thus some foundry work will be closely tied with the activities of the automotive industry, or influenced by the demand for farm implements, heavy machinery of all types, electrical goods, railway rolling stock, aircraft,

and military and naval weapons, shells, bombs and other heavy metal items, including ships. In the absence of any great demand for war materials, there is likely to be, in times of full employment, a considerable volume of business in durable consumer goods, from soil pipe to stoves, refrigerators and washing machines, and other items embodying some castings.

In spite of the obviously fluctuating nature of this industry's activities, it does not appear, from regional reports of the National Employment Service over the post-war period, that any noticeable surplus of furnacemen, moulders, coremakers, casters or pattern-makers has occurred during that period; indeed there have been recurrent shortages of these workers. There has undoubtedly been some local unemployment resulting from shortages of raw materials, for brief intervals during the same years.

Considerable labour turnover, in the unskilled categories, has been a feature of the foundry industry, especialy in hot seasons, in Southern Ontario, when outdoor employment has been available for this type of labour.

There is likely, it would appear, to be growing export demand for foundry products, conditioned by exchange factors which seem to be becoming more favourable to foreign commerce. The increasing mechanization of agriculture, even in backward areas of the world, will afford new and increasing markets for Canada's already large agricultural implement and automotive industries.

The trend towards establishment of overseas plants by some Canadian companies may provide new opportunities for skilled Canadian workers. The reverse movement to establish the Canadian plants of British and United States firms will entail further employment of Canadians, as has already happened, in the case of certain manufacturers of aircraft and automobiles.

The impending development of new base metal mines, especially iron and copper, and even titanium and lithium producers, will provide raw materials hitherto imported

to a great extent, and new metals requiring new processes, and should cause an expansion in all industries in which foundry work has a share. Similarly, all important new hydro-electric developments will create new demands requiring more or less foundry work.

Should some classes of durable consumer goods prove, with rising costs, to be priced beyond the margin of effective demand, there may be some set-back to this industry until an adjustment is made.

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Canadian Legion Educational Services, "Let's Consider Jobs" series *Foundry Work* (1945).

Connecticut State Department of Education *Foundry Practice as a Vocation* (1945).

Science Research Associates, Chicago, Occupational Brief *Foundrymen.*

National Founders Association, 120 South La Salle St., Chicago, Ill., publishes booklets on specific foundry operations.

AUDIO-VISUAL MATERIAL

Readers desiring information on film sources, available material, and the organization of local film services may obtain it from the National Film Board offices listed in Monograph 1, "Carpenter".

LOCAL INFORMATION

LOCAL INFORMATION

LOCAL INFORMATION

"CANADIAN OCCUPATIONS" SERIES

The monographs listed below, accompanied by pamphlets, except in the case of numbers 13 and 20-35, have been published to date. Those from 20-35 have been published collectively.

(1) *Carpenter*

(2) *Bricklayers and Stone Masons*

(3) *Plasterer*

(4) *Painter*

(5) *Plumber, Pipe Fitter and Steam Fitter*

(6) *Sheet-Metal Worker*

(7) *Electrician*

(8) *Machinist and Machine Operators (Metal)*

(9) *Printing Trades*

(10) *Motor Vehicle Mechanic and Repairman*

(11) *Optometrist*

(12) *Social Worker*

(13) *Lawyer*

(14) *Mining Occupations*

(15) *Foundry Workers*

Careers in Natural Science and Engineering: (20-35)

(20) "Agricultural Scientist"

(21) "Architect"

(22) "Biologist"

(23) "Chemist"

(24) "Geologist"

(25) "Physicist"

(26) "Aeronautical Engineer"

(27) "Ceramic Engineer"

(28) "Chemical Engineer"

(29) "Civil Engineer"

(30) "Electrical Engineer"

(31) "Forest Engineer and Forest Scientists"

(32) "Mechanical Engineer"

(33) "Metallurgical Engineer"

(34) "Mining Engineer"

(35) "Petroleum Engineer"

DEPARTMENT OF LABOUR

Economics and Research Branch

OTTAWA, 1951

OTTAWA
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CANADIAN OCCUPATIONS

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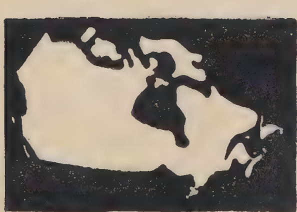
FOUNDRY WORKERS



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MONOGRAPH 15
REVISED 1957

DEPARTMENT OF LABOUR, CANADA

CANADIAN OCCUPATIONS

★

FOUNDRY WORKERS

MONOGRAPH 15

REVISED 1957

HON. MILTON F. GREGG, V.C., MINISTER

A. H. BROWN, DEPUTY MINISTER

DEPARTMENT OF LABOUR, CANADA

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FOREWORD

During recent years there has been a steadily increasing demand for up-to-date information on occupations.

This demand comes from youth faced with the need of choosing an occupation and of selecting the type of training required; from parents, teachers and other counsellors; from workers shifting to other occupations; from employment service officers; from directors of personnel and union officials, and from other quarters.

This series of monographs and an accompanying series of pamphlets, the latter containing similar information in a condensed form, are attempts to meet this demand. These publications are designed for general use and cover a wide range of occupations, including professions. They indicate, among other things, the nature of the occupation or group of occupations, entrance and training requirements, working conditions and opportunities in each.

The staff of the Occupational Analysis Section has prepared this series with the generous assistance of representatives of management, trade unions, and professional associations. The cooperation of the Unemployment Insurance Commission, the Vocational Training Branch of the Department of Labour, and the Dominion Bureau of Statistics is gratefully acknowledged.

Acknowledgment is also made of the assistance obtained from numerous publications on occupations prepared in Canada and in other countries.

DIRECTOR,
Economics and Research Branch,
Department of Labour.

January 1957.

FOUNDRY WORKERS

HISTORY AND IMPORTANCE

Foundry products are an important part of twentieth century living and industrial development. All manufactured goods depend, either directly or indirectly, on metal castings to form the component parts or to make the machinery used in production.

It is estimated that a modern five-room house requires over two tons of metal castings to make it comfortable. Bath tubs, water faucets, sewer pipes, furnace and stove parts, electric irons, sewing machines, and a host of other items common in homes all use castings. The family car also requires many hundreds of pounds of metal castings.

The machine goods industry, transportation, construction, agriculture and communication all depend on a wide range of foundry products of special design and materials. Machines and machine tools, railway equipment, ships, aircraft, trucks, combines and other farm equipment, bulldozers and heavy earth-moving equipment are only a few of the many items using foundry products. Foundries are also important for defence purposes, in turning out parts for aircraft, tanks, guns, shells, bombs and other military equipment.

Metal castings are produced in the foundry by pouring molten metal into moulds of the desired shape and allowing it to cool and harden. The variety of shapes and sizes of castings is almost limitless, and may range from tiny metal gears weighing less than an ounce to huge press beds weighing many tons.

To meet the need for substances able to withstand heat and corrosion, conduct electricity or to meet other requirements, some 600 alloys are now being cast in foundries. The principle metals used are malleable iron, cast iron, steel, aluminum, magnesium, copper, lead, zinc, tin, and alloys of these metals, including brass and bronze.

It is not known when man first produced shaped metallic objects by pouring molten metal into a mould. Genesis 4 tells of Tubal Cain, "an instructor of every artificer in brass and iron", and it is recorded in II Chron. 5, that the temple pillars, brass

altar, and other metal objects for King Solomon's temple were cast in the clay soil of the plains of Jordan. Whether many works of this nature were produced in ancient times is questionable. It is certain that the casting of metal statues was common practice in Renaissance times, and equally certain that as soon as cannon graduated from leather bombards to solid metal they could have been made so only by casting.

In Canada the first foundry was established at St. Maurice in 1737. It operated for over a century, even exporting castings, until the ore supply became exhausted. The Normandale Furnace in Central Ontario and the New Glasgow plant in Nova Scotia were nineteenth century pioneer undertakings producing cast iron and steel.

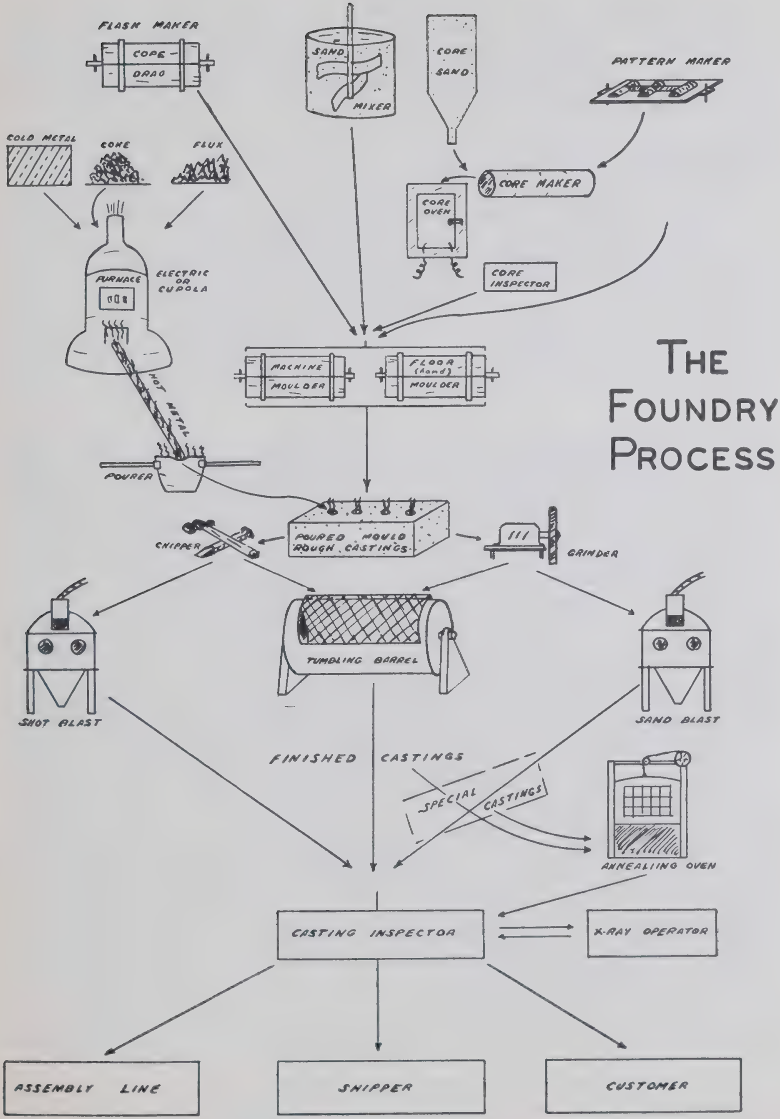
From these small beginnings has grown a strong industry. There are about 400 foundries engaged primarily in making castings and forgings or in making such products as cast iron or malleable iron pipe and fittings. In 1942, the peak production war year, there was an output of 575,000[1] tons of iron castings; by 1955 it had increased to 905,000[1] tons and there are indications of the output being even higher in 1956. Statistics on foundry production are not available for firms operating foundries secondary to their chief operations or for those using metals other than iron. However, the fact that industry generally has made such spectacular advances would indicate that production of castings in these areas is also on the increase.

There are two broad groups of foundries, based on the nature of their undertakings.

(a) "Custom" or "Job" foundries are independent shops, often small, that have developed throughout the country to supply the local need for foundry products. They usually specialize in producing a limited number of castings of the same pattern, and in developing patterns and special castings for customers. As well as this custom work, many of them have contracts to supply castings in quantity for other industries.

(b) "Captive" or "Integrated" foundries are departments of a larger enterprise primarily engaged in the manufacture of products which require castings, such as stoves, automobiles, locomotives

[1] Dominion Bureau of Statistics, *The Iron Castings Industry*.


FLASH MAKER
COPE
DRAG
SAND
MIXER
CORE
SAND
PATTERN MAKER
COLD METAL
COKE
FLUX
CORE MAKER
CORE
OVEN
FURNACE
ELECTRIC
OR
CUPOLA
CORE
INSPECTOR
MACHINE
MOULDER
FLOOR
(hand)
MOULDER
THE
FOUNDRY
PROCESS
HOT METAL
POURER
CHIPPER
POURED MOULD
ROUGH CASTINGS
GRINDER
TUMBLING BARREL
SHOT BLAST
SAND BLAST
FINISHED CASTINGS
SPECIAL CASTINGS
ANNEALING OVEN
CASTING INSPECTOR
X-RAY OPERATOR
ASSEMBLY LINE
SHIPPER
CUSTOMER

or agricultural implements. Some "captive" foundries also do jobbing work or even have a sideline, so as to provide steady employment for workers and to ensure the most economical use of expensive equipment.

FOUNDRY PROCESSES

In general, the work of a foundry consists of melting metal in a furnace, and pouring the molten metal into sand moulds shaped according to a pattern. The rough casting taken from the mould is cleaned, smoothed and finished by using grinders or abrasives.

Before the foundry process is set in motion, the manager, assisted by his technical and clerical staff, must estimate the job in terms of equipment needed, labour, material costs, and delivery dates.

Two groups of professional men, the *foundry chemist* and the *metallurgist,* may be concerned in establishing the qualities and properties of the metals to be used for specific castings. In some cases the metallurgist is a consultant, and not a member of the staff. These two professions, dealt with in our booklet "Careers in Natural Science and Engineering", will not be further mentioned in this monograph.

As a rule, foundries consist of a number of departments: Patternmaking, Coremaking, Moulding, Melting and Pouring, Finishing and, in some cases, Laboratory Control. These departments may be combined in smaller foundries, and subdivided in larger ones where many types of castings are produced.

Patternmaking

The first step in the foundry process is the development and construction of a pattern. It may be of wood, metal, plaster, plastic or clay, and is slightly larger than the casting to allow for shrinkage of the metal on cooling. In many cases the customer will supply the foundry with a pattern made in his own shop or by a firm specializing in patternmaking.

Coremaking

Although the pattern will determine the exterior shape of the casting, the interior of hollow castings is produced by *cores,* which

are placed in the mould so that the molten metal will flow around them.

Cores are made of sand which has been bonded together with oil and pressed into the proper shape. They are then baked in an oven to give them hardness and strength to resist the flow of metal as it is poured into the mould. The intense heat of the molten metal about the core burns the oil from the sand, which is then shaken out of the casting when it is removed from the mould.

Many smaller cores, particularly those required in quantity, are now being made of a resin or plastic and sand mixture, and are hollow instead of solid. New machines and materials have greatly simplified the core-making process, and for many repetitive jobs it is only in setting up the machinery for the first core that much skill is required.

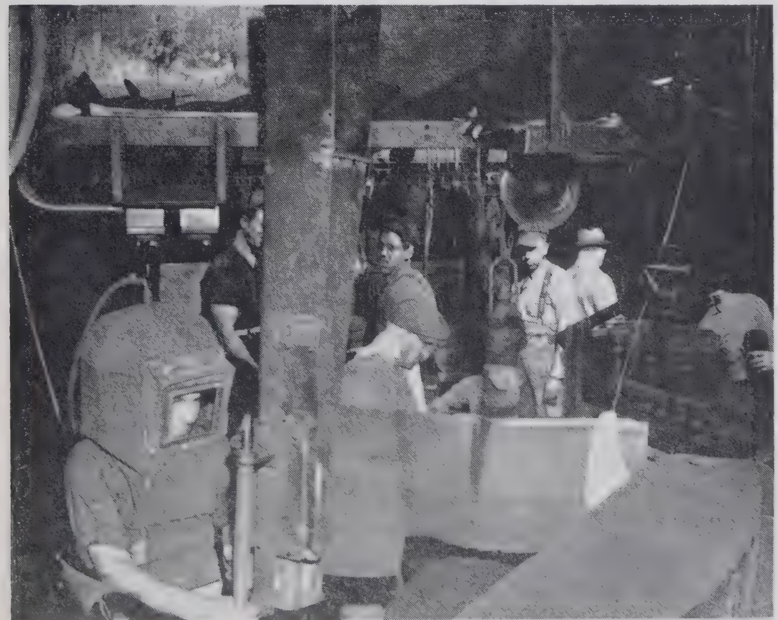


Photo: N.F.B.

A corner of the coremaking department.

Moulding

Moulding is the very essence of the foundry process. All but very large moulds are set up in *flasks* — metal or wood containers having a top section, the *cope,* and a bottom section, the *drag*. The pattern is inserted into the drag and wet sand or loam is packed tightly around it. The cope is then placed over the drag and more wet sand packed tightly around the top half of the pattern. When the flask is opened and the pattern removed, each section bears the imprint of the pattern. Channels are cut in the sand to permit the proper distribution of the molten metal and allow air and gases to escape. Cores, if any, are fastened into position. The cope is again placed on the drag and securely fastened. It is then ready to receive the molten metal.

Machine moulding has made possible the large scale production of identical castings by reducing the skill required for the moulding process and at the same time has greatly speeded up the operation.

Melting

The metal is melted in the appropriate one of the following types of furnace: the *cupola,* used mostly for melting iron, and burning coke as a fuel; the *electric furnace,* extensively used because of the high temperatures that can be attained, and the absence of gases from fuel combustion; the *reverberatory* or *air furnace,* in which the metal is melted without coming into contact with the fuel; the *tilting furnace,* used mostly for non-ferrous metals; the *open-hearth furnace,* most economical in melting large quantities of steel; the *crucible,* used for melting small quantities, is embedded in a fire until the metal is molten.

After each heat the furnaces must be checked, repaired and relined if necessary.

Finishing

When rough castings are removed from the mould they are shaken free of sand. Projections which are left at the vents and pouring points are removed by grinding or chipping. To remove rough surfaces, castings are placed with metal shot or other substances in a revolving drum such as a tumbling barrel, or placed

in a revolving chamber (wheelabrator) and blasted with sand, iron filings or steel shot. Depending on the finished product, the castings may be given further processing prior to annealing, enamelling or other finishing.

The castings may then be checked to ensure that the dimensions and surface finish are according to specifications. In some cases the internal structure is examined by X-ray.

DUTIES

The foundry industry offers employment to a wide range of workers — from the highly technical and supervisory type of worker to men with limited experience or training. The mechanization of the industry has led to the use of semi-skilled machine operators who can be trained to proficiency in a short time, but the highly skilled patternmakers, moulders and coremakers are still the backbone of the foundry group.

Patternmaking

The finished product is only as good as the pattern which forms it. Therefore, it is imperative that the man who is responsible for these patterns be skilled in his trade. Using known techniques and working from blueprints, the *patternmaker* constructs a form that will give the desired shape to the casting and that can be removed from the sand without disturbing it.

The worker may be designated according to the material with which he works — patternmaker, wood; metal; plaster; or clay.

The patternmaker working in wood chooses the kind of wood suitable for the job — usually white pine, oak, maple, mahogany or cherry — and lays out and marks the pattern on it. Using woodworkers' hand and power tools he cuts out the pieces, sands and treats them with paint or shellac and assembles them.

A metal patternmaker uses metal stock or a rough casting to form the metal pattern. He shapes the parts, using lathes, shapers, files, grinders and other metal-working tools, and assembles the parts, fastening them together by brazing, soldering or with machine screws. The pattern is checked regularly with precision measuring instruments and finished by scraping, filing and polishing.

Usually the patternmaker will mark on the pattern where the cores are to be placed in the mould for the desired contours or cavities.

Coremaking

The *coremaker* forms a facsimile of the desired interior shape of the hollow casting from specially prepared sand. Makers of some complex cores may still construct the core boxes and fill them with sand by hand or machine. Much of the repetitive work, however, is now done on machines that are tooled up to do the job quickly and efficiently and so require only a machine operator.

The *oventender* regulates the baking ovens, depending on the bulkiness of the core, *trimmers* remove any roughness or projec-

Photo: N.F.B.

Pouring number plates.

tions on the cores and *handlers* transport and store the cores until they are required.

Moulding and Pouring

The *sand cutter* prepares mixtures of sand, clay, water and binding material, as prescribed by the *sand control man,* the *sand tester,* or *moulder,* for making moulds or cores. The fresh sand and reclaimed material from previous moulds and cores is fed by hand or machine into a sand mill which breaks it up and mixes it. In modern foundries the proportions of sand and bonding materials are placed in a machine and the controls set for a specific mixture. The sand is carried on a conveyor-belt to hoppers and released by the moulders as required.

When small moulds are being made by hand the work is done at a bench. The *bench moulder* fits the pattern into the flask, packs sand around it using a rammer and riddle (sieve) and fastens together the two halves of the flask. When the flask is opened and the pattern removed, any defects in the impression are repaired and vents are inserted to allow gas to escape and to provide channels for pouring. Where necessary, cores are placed in position, sometimes on special supports (chaplets) which become imbedded in the casting. The moulder then replaces the cope on the drag and places it on the floor or conveyor for pouring. In some foundries he may do the pouring.

The *floor moulder* constructs large sand moulds on the foundry floor for the production of large castings. The sand is rammed in by hand or machine and is often reinforced by pushing nails (chills) into it. As the cope is heavy, he is usually assisted in placing the cope on the drag by a *crane operator.* He also may pour metal into the mould.

The *machine moulder* operates one or more of several types of moulding machines, manually or power driven, to produce large quantities of identical moulds. He assembles the flask sections, and positions the pattern in the flask, then fills the flask compactly with sand either manually or using a jarring, jolting or squeeze machine. He controls the machine for withdrawing the pattern, replaces the cope on the drag, closes the mould with clamps, and places it on the floor for pouring.

The *ladleman* (pourer, metal) receives molten metal in ladles at the furnaces and transports the ladle to the moulds for pouring. The moulds are filled by tilting the ladle and pouring molten metal over the lip into the moulds.

Melting

The quantities of coke, limestone and iron, as determined beforehand by the metallurgist, are brought to the charger door in wheelbarrows, trucks or small rail cars, and shovelled in by hand or fed by a charging machine by the *cupola charger*. He may also assist the cupola furnace tender to clear away residue from below the cupola and to repair the cupola furnace lining.

The *cupola tender* (furnaceman or melter) is in charge of the cupola furnace. Before the fire is lit he supervises the cupola chargers in their work; in small foundries he may assist them. Once the "heat" is on he regulates the air blast which fans the flames and from time to time draws off the slag. When the level of the molten metal is high enough, he taps the furnace by poking out the plug (bott) and spout (tap hole), allowing the iron to flow into the ladles.

When the furnace has cooled he either assists in repairing the interior of the cupola and preparing it for the next heat or supervises helpers in these tasks.

The *electric-furnace operator* carries out much the same duties as the cupola tender except that in this case the heat is supplied by electricity. He controls the temperature, watching the ammeter and voltmeter to maintain proper current and voltage.

Finishing

When the casting is cool enough to handle, *shifters* remove the sand by hand or using a vibrating machine designed for the purpose. *Burners* follow blueprints in cutting away excess metal and projections, using oxyacetylene or special flame-cutting equipment. They may have to lift and turn large castings by hoist. *Chippers* and *grinders* continue the cleaning process by removing excess metal from the casting—using hand or pneumatic hammers, chisels and grinding wheels — and smoothing the rough spots with a file. In cases where a particular kind of surface is required, such as one for enamelling, the *sand blaster* puts the casting into a cham-

ber and plays over it blasts of compressed air mixed with sand or other abrasive materials. The *wheelabrator operator* also cleans castings of sand and rough surfaces by the abrasive action of steel shot. He places the castings on the revolving platform or roller conveyor of the wheelabrator, and manipulates the controls to start the shot blast mechanism. He removes the cleaned castings from the machine, placing them on a truck or conveyor for the next operation.

Before some castings can undergo further processing they must be heat treated (annealed). The *annealer* loads the castings into the furnace by hand, conveyor system, crane or electric truck and regulates the heat treatment by the furnace pyrometer in order to maintain correct temperature. He allows the oven to cool slowly before removing the castings.

Inspectors may be stationed at various points to check the castings, rejecting those that are cracked or otherwise defective, and checking for conformance with blueprint specifications. They may mark excess metal for removal or suggest salvage methods for partially defective castings.

Other Occupations

Labourers may be employed in many phases of the work — assisting other workers, transporting and lifting materials and finished products, and working as cleaners.

Blacksmiths, electricians, machinists, millwrights and *carpenters* work in and about the plant installing and repairing plant equipment, making alterations and, in general, performing the duties peculiar to their trades.

Bookkeepers, general clerks, office appliance operators and *stock record clerks* are required to carry on the office work and clerical duties necessary in any business.

QUALIFICATIONS

Heavy muscular work was once a typical feature of most foundry work. Although modern equipment, such as hoists and cranes, conveyor-belts and other foundry machinery, has reduced the amount of heavy work involved, the young man entering this industry must still be strong and robust. Heat and fumes are un-

avoidable in most foundry operations, consequently those with pulmonary complaints should avoid this work. Foundry workers must be nimble and alert, in order to avoid danger from molten metal, moving objects, and other hazards.

There is no set age limit for entry into foundry work, but apprenticeship in the skilled trades is usually reserved for young men under 20.

Educational standards are not particularly rigid, but secondary or technical school education, especially in subjects relating to physics, chemistry and metallurgy, are an advantage. Some large firms that have formal apprenticeship schemes require grade XI standing.

The worker in this industry is part of a production team. He must, therefore, be able to understand orders and carry them out quickly, and to co-operate with fellow workers. He requires a good measure of judgment, and must always consider his own safety and that of others, in carrying out his duties.

TRAINING

Moulding and patternmaking are trades designated for apprenticeship in British Columbia. A number of firms across Canada have formal apprentice training schemes for skilled foundry trades, the training period varying from four to five years.

Increased use of production machinery is changing, to some extent, the emphasis from skilled craftsmen to a new group called machine operators. However, patternmakers, floor and bench moulders, and coremakers are still necessary in carrying out the basic foundry operations. In modern plants, machines for moulding, cleaning and finishing castings, mixing sand, and transporting material are tended by machine operators. After a short period of instruction the learner is expected to become an efficient operator in about a month's time.

ENTRY

Local offices of the National Employment Service and placement officers of technical and vocational schools are in a position to assist young men to locate openings in foundry work. Some firms prefer to hire youths introduced by their own employees or

by business contacts, and many advertise in the employment columns of newspapers. Employment leads may also be found in the yellow pages of the telephone directory under the headings "Foundries", "Steel", "Machine Shops", etc.

EARNINGS

Average hourly earnings for foundry workers are among the highest in the manufacturing field. At October 1, 1956, the average hourly rate was $1.71 as compared with $1.53 for all manufacturing industries.

The average hours per week worked by those engaged in the manufacture of iron castings was 42.9.

The earnings of the individual worker will vary considerably, depending on the locality and unionization.

Rates given in the following tables are taken from the annual report, *Wage Rates and Hours of Labour in Canada,* published by the Department of Labour, Canada.

HOURLY WAGE RATES PAID IN THE IRON CASTINGS INDUSTRY, OCTOBER 1, 1956

Occupation	Locality	Average	Range
		$	$
Patternmakers	Canada	1.92	—
	Atlantic Provinces	1.73	1.45 — 2.63
	Quebec	1.91	1.38 — 2.22
	Montreal	2.12	1.88 — 2.22
	Ontario	1.96	1.63 — 2.26
	Toronto	2.03	1.82 — 2.20
	Manitoba	1.69	1.60 — 1.76
	Alberta	1.76	1.65 — 1.96
Coremakers	Canada	1.59	—
	Quebec	1.47	1.10 — 1.90
	Montreal	1.64	—
	Ontario	1.64	1.41 — 2.11
	Toronto	1.65	1.48 — 2.12
	Manitoba	1.45	1.26 — 1.62
	Alberta	1.65	1.15 — 1.91
	British Columbia	1.95	1.76 — 2.00
Moulders (Bench)	Canada	1.58	—
	Quebec	1.43	1.15 — 2.04
	Ontario	1.60	1.35 — 1.86
	Toronto	1.69	1.56 — 1.91
	Prairie Provinces	1.58	1.40 — 1.62
	British Columbia	2.04	2.00 — 2.05

HOURLY WAGE RATES PAID IN THE IRON CASTINGS INDUSTRY, OCTOBER 1, 1956. (Concluded)

Occupation	Locality	Average	Range
		$	$
Moulders (Floor)	Canada	1.62	—
	Atlantic Provinces	1.47	1.43 — 1.60
	Quebec	1.47	1.23 — 1.71
	Ontario	1.69	1.40 — 2.00
	Toronto	1.88	1.57 — 2.12
	Manitoba	1.56	1.41 — 1.69
	Alberta	1.67	1.40 — 1.91
	British Columbia	2.02	2.00 — 2.05
Moulders (Machine)	Canada	1.52	—
	Quebec	1.37	1.00 — 1.82
	Ontario	1.65	1.50 — 1.86
	Toronto	1.63	1.54 — 1.72
	Manitoba	1.46	1.35 — 1.52
	Alberta	1.52	1.30 — 1.63
	British Columbia	2.03	2.00 — 2.05
Sand Cutters (Sand Mixers)	Canada	1.43	—
	Quebec	1.29	1.00 — 1.62
	Montreal	1.43	1.00 — 1.68
	Ontario	1.53	1.34 — 1.73
	Toronto	1.52	1.44 — 1.63
	Alberta	1.47	1.30 — 1.52
Chippers and Grinders	Canada	1.47	—
	Atlantic Provinces	1.25	1.18 — 1.25
	Quebec	1.23	1.10 — 1.74
	Ontario	1.56	1.27 — 1.89
	Toronto	1.53	1.41 — 1.61
	Manitoba	1.40	1.31 — 1.47
	Alberta	1.49	1.30 — 1.61
	British Columbia	1.80	1.76 — 1.81
Labourers	Canada	1.43	—
	Atlantic Provinces	1.17	—
	Quebec	1.26	.90 — 1.56
	Montreal	1.41	1.38 — 1.56
	Ontario	1.47	1.31 — 1.71
	Toronto	1.49	1.44 — 1.54
	Manitoba	1.36	1.28 — 1.41
	Alberta	1.35	1.20 — 1.41

ADVANTAGES AND DISADVANTAGES

The skilled workers in this industry are in demand in times of general industrial activity.

Pay is comparable, for all grades of workers, to that for equal grades of skill in heavy industry generally.

The workers are well organized.

Unemployment Insurance and Workmen's Compensation apply to this industry.

In the case of the more skilled men, such as patternmakers, coremakers and moulders, there is variety of work and the satisfaction which results from a knowledge of a personal share in a good product.

Working conditions in larger establishments have been much improved in recent years.

In all establishments, however, there are of necessity areas where abnormal heat must be tolerated. In less modern shops there may be danger for the careless in the wide distribution of hot metal in various stages of the foundry process, necessitating cautious movement. There is also danger from careless pouring, from improperly vented moulds, and other results of human fallibility. Accidents and injuries are, however, infrequent.

Noise is not a serious factor in most foundries.

It is not possible, in view of the wide and varied distribution of foundry work, to generalize about hours, pension schemes, and vacations with pay. It may be said that in large industries having "captive" foundries the foundry workers will share, where they are members of an industrial union, in such benefits as are in the general union contract.

ORGANIZATIONS

In most very large metal working industries such as automobile, aircraft, and heating apparatus, embodying a foundry shop, the workers will be members of the industrial union under contract with the management.

Many smaller shops, and a few larger ones, are organized by the International Molders' and Foundry Workers' Union of North America. This applies especially to independent foundries doing custom work.

A number of patternmakers belong to the Pattern Makers' League of North America, which has locals in several of the larger cities.

ADVANCEMENT

The line of advancement in this industry is approximately: Patternmaker's apprentice, to Patternmaker, to Foreman Patternmaker (in large establishments); Cupola Tender or Furnace Tender to Cupola Operator; Apprentice Moulder or Moulder's Helper to Moulder, to Foreman Moulder; Apprentice Coremaker or Coremaker's Helper to Coremaker, to Foreman Coremaker; Ladleman's or Pourer's Helper to Ladleman or Pourer.

The occupations of Burner or Cutter, Chipper and Grinder, Wheelabrator Operator, Sand Blaster, and similar finishing workers, may lead to that of Inspector.

Foremen may become Shop Superintendents in larger plants.

The variation in size and nature of operation of foundry plants makes any generalization on line of promotion impossible. Many men who start in labouring-type jobs may graduate to semi-skilled work, and from that to skilled employment, since apprenticeship is not generally formal, where it does exist, except in very large plants.

RELATED OCCUPATIONS

The trade of patternmaker in foundry work is more or less related to that of patternmakers in any industry making moulds and casting non-metallic substances.

That of furnace operators is akin to that of operators of furnaces in rolling mills and in metal refineries.

There is some relation between the skills of a machine moulder and of moulders of ceramic products.

The work of the chipper and grinder is closely parallel to that of the operator of grinding machines in any industry.

That of the burner or cutter is similar to that of welders and flame cutters in any industry.

Annealers or heat treaters are common to many metal industries.

Coremakers are peculiar to foundry work.

The various helpers and labourers, and operators of machines requiring no particular skill, can be regarded as transferable to any heavy industry.

TRENDS

Distribution of Workers

Complete data for employment in the foundry industry are not available. Among the many jobs associated with foundry work, three occupations — patternmaker, moulder and coremaker — are characteristic of the industry. The following tables show the distribution of these workers throughout Canada, and in the manufacturing industries in which the majority of them find employment:

DISTRIBUTION OF SELECTED FOUNDRY OCCUPATIONS BY PROVINCE, 1951.

	Pattern-maker	Moulder	Coremaker
Canada	2,311	9,542	2,089
Newfoundland	12	35	1
Prince Edward Island	1	10	1
Nova Scotia	65	278	33
New Brunswick	37	199	26
Quebec	714	2,773	243
Ontario	1,266	5,318	1,644
Manitoba	51	383	61
Saskatchewan	1	30	3
Alberta	26	119	17
British Columbia	138	397	60

Source: 1951 Census.

Photo: N.F.B.

Mechanization speeds up the foundry process.

DISTRIBUTION OF SELECTED FOUNDRY OCCUPATIONS IN MANUFACTURING, 1951.

	Pattern-maker	Moulder	Coremaker
Iron and Steel Products	1,024	6,920	1,494
Transportation Equipment . . .	581	1,097	210
Non-Ferrous Metal Products . .	124	917	247
Electrical Apparatus and Supplies	102	272	106
Non-Metallic Mineral Products.	19	63	—
Miscellaneous Manufacturing .	461	273	32

Source: 1951 Census.

Future Prospects

Since foundries are dependent on, and in many cases integrated with, a wide variety of other metal industries, they are inevitably affected by the demand for such products as automobiles, farm implements, heavy machinery of all types, electrical goods for industry and the home, railway rolling stock, aircraft, and military and naval weapons. General business conditions will, therefore, markedly influence employment in this industry.

At the present time, the high level of capital investment in Canada, the rapid development of its natural resources, and an increasing population, are creating strong demands for capital and consumer goods, of which metal castings are an important part.

There is a noticeable trend towards the greater use of machines and mechanical aids in foundry work. One result of mechanization has been a greater need for machine operators. Because machines have tended to reduce the skill content of the work, particularly in the case of foundries engaged in quantity production of smaller castings, the need for apprentices has been reduced to some extent. At the same time, it is known that the industry is experiencing difficulty in attracting an adequate number of apprentices of suitable calibre for the skilled foundry trades.

Even though new methods of machining metal, die-casting powdered metal, and the increasing use of pressed and welded sheet metal have cut into the demand for foundry castings to some extent, the product of the foundry is still very much in demand by industry and will continue to be so for many years to come.

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LOCAL INFORMATION

LOCAL INFORMATION

"CANADIAN OCCUPATIONS" SERIES

Monographs and Pamphlets

The monographs listed below, accompanied by pamphlets, except in the case of numbers 12, 13 and 39, have been published to date.

(1) Carpenter
(2) Bricklayers and Stone-Masons
(3) Plasterer
(4) Painter
(5) Plumber, Pipe Fitter and Steam Fitter
(6) Sheet-Metal Worker
(7) Electrician
(8) Machinist and Machine Operators (Metal)
(9) Printing Trades
(10) Motor Vehicle Mechanic
(11) Optometrist
(12) Social Worker
(13) Lawyer
(14) Mining Occupations
(15) Foundry Workers
(16) Technical Occupations in Radio and Electronics
(17) Forge Shop Occupations
(18) Tool and Die Makers
(19) Railway Careers

Careers in Natural Science and Engineering: (20-35, one booklet)

(20) Agricultural Scientist
(21) Architect
(22) Biologist
(23) Chemist
(24) Geologist
(25) Physicist
(26) Aeronautical Engineer
(27) ——
(28) Chemical Engineer
(29) Civil Engineer
(30) Electrical Engineer
(31) Forest Engineer and Forest Scientist
(32) Mechanical Engineer
(33) Metallurgical Engineer
(34) Mining Engineer
(35) Petroleum Engineer

(36) Hospital Workers (Other than Professional)
(37) Draughtsman
(38) Welder
(39) Careers in Home Economics
(40) Occupations in the Aircraft Manufacturing Industry
(41) Careers in Construction

Filmstrips

The Department of Labour has prepared, to date, the following occupational filmstrips in collaboration with the National Film Board. A manual has been prepared as an accompaniment to each filmstrip. These may be purchased from the National Film Board, Box 6100, Montreal, or from any one of its regional offices.

Plumber, Pipefitter and Steamfitter
Careers in the Engineering Profession
The Social Worker
Technical Occupations in Radio and Electronics
Bricklayer and Stone-Mason
Printing Trades
Careers in Natural Science
Careers in Home Economics
Motor Vehicle Mechanic

DEPARTMENT OF LABOUR

Economics and Research Branch

CANADA, 1957

HULL
EDMOND CLOUTIER, C.M.G., O.A., D.S.P.
QUEEN'S PRINTER AND CONTROLLER OF STATIONERY

CANADIAN OCCUPATIONS

★

TECHNICAL OCCUPATIONS IN RADIO AND ELECTRONICS

★

MONOGRAPH 16

DEPARTMENT OF LABOUR, OTTAWA

CANADIAN OCCUPATIONS

★

TECHNICAL OCCUPATIONS IN RADIO AND ELECTRONICS

MONOGRAPH 16

HON. MILTON F. GREGG, V.C., MINISTER
ARTHUR MACNAMARA, C.M.G., LL.D., DEPUTY MINISTER

DEPARTMENT OF LABOUR, OTTAWA

FOREWORD

During recent years there has been a steadily increasing demand for up-to-date information on occupations.

This demand comes from youth faced with the need of choosing an occupation and of selecting the type of training required; from parents, teachers and other counsellors; from workers shifting to other occupations; from employment service officers; from directors of personnel and union officials, and from other quarters.

This series of monographs and an accompanying series of pamphlets, the latter containing similar information in a condensed form, are attempts to meet this demand.

These publications represent an expansion of an earlier series issued by the Department of Veterans Affairs to assist members of the armed forces returning to civilian life following the end of the war. These current series, designed for general use, cover a wide range of occupations, including professions. They indicate, among other things, the nature of the occupation or group of occupations, entrance and training requirements, working conditions and opportunities in each.

The monographs have been prepared by our research staff working on occupations, with the generous help and advice of officials of the Unemployment Insurance Commission, Vocational Training Branch of the Department of Labour, Dominion Bureau of Statistics, Provincial Departments of Education and of Labour, employers' associations, trade unions, professional associations, and other government and non-government bodies.

Grateful acknowledgment is made of this assistance and that obtained from numerous publications on occupations prepared in Canada and in other countries.

DIRECTOR,
Economics and Research Branch,
Department of Labour.

July, 1951.

INDEX

		Page
I.	HISTORY AND IMPORTANCE	5
II.	BROAD FIELD OF WORK	11
III.	RADIO OPERATORS (Certificated)	12
	Radio Operators on Department of Transport stations, ship radio officers, flight radio officers and ground radio operators (civil aviation).	
	Main Types of Station and Certification Required	13
	Nature of Work	16
	Qualifications	16
	Training	17
	Employment Outlook	18
IV.	TECHNICAL OCCUPATIONS IN SOUND AND TELEVISION BROADCASTING	20
	Sound Broadcasting Operators	20
	Studio or control-room operator, master control operator, transmitter operator, field operator, recording operator, general operator, learner.	
	Television Broadcasting Operators	22
	Learner, video camera operator, video studio operator, audio studio operator, television studio and field microphone operator, transmitter operator, field operator, projection-room operator.	
	Qualifications and Training for Broadcasting Operators	25
	Broadcasting Technicians and Engineers	26
	Maintenance technician, mechanical technician, research technician, graduate engineers.	
	Employment Outlook	27
	Sound Broadcasting	27
	Television Broadcasting	29
V.	TECHNICAL OCCUPATIONS IN THE MANUFACTURE OF RADIO, TELEVISION AND OTHER ELECTRONIC EQUIPMENT	32
	Nature of Work	32
	Radio engineer, machine operators, assemblers and wiremen, testers and inspectors, receiver testers, transmitter testers.	
	Qualifications and Training	36
	Employment Outlook	37

Page

VI. OCCUPATIONS IN SERVICING OF ELECTRONIC EQUIPMENT 40
Radio Repair Shop Work 40
Servicing of Industrial, Commercial and Scientific Electronic Apparatus 41
Radar Technicians 42
Radio Servicemen in other Fields 42
Qualifications 42
Training 43
Employment Outlook 44

VII. EARNINGS 47
Radio Operators (Certificated) 47
Radio Broadcasting Operators and Technicians 48
Radio Manufacturing 49
Radio Servicemen and Technicians 49

VIII. ORGANIZATIONS 51

IX. REFERENCES 52

TECHNICAL OCCUPATIONS IN RADIO AND ELECTRONICS

Photo N.F.B.

Ship radar screen showing harbour outline

I. HISTORY AND IMPORTANCE

The word "radio" has been defined as "communication by means of electro-magnetic waves through space". Put another way, it is the process of electrically transmitting and receiving — without the use of wires —

sound, images or any signal which can be converted into light or sound, or can be detected electrically.

The main branches of radio are distinguished by the method of transmission and reception used. In *radiotelegraphy*, communication is achieved by means of a telegraphic code signal; in *radiotelephony*, words, music, or any other audible sound is transmitted and received; in *radio-facsimile* or *radio-photo transmission*, a fixed image is communicated; in *television*, not only sound but moving images are sent and received; in *radar*, short bursts of high frequency transmission are used which, when reflected from an object and received, are converted into a signal which can be seen on a cathode-ray tube.

The heart of radio is the *electronic vacuum tube* or *valve*. These tubes, which at one time had their application in radio communication only, are now used to great effect for industrial, commercial, scientific and medical purposes. A broader, more general term — *"Electronics"* — is now used to describe the whole field in which electronic tubes and their associated circuits have their application. Radio, in the sense described above, is thus only a part, albeit an important part, of the greater field of electronics.

The science of electronics has advanced so rapidly in the last twenty years or so, and particularly in the past ten years, that it is difficult to appreciate that it was only sixty-two years ago that the German scientist, Hertz, produced and detected, for the first time, electromagnetic radiation. Hertz's findings were made possible by the previous work of the English scientists, Faraday and Maxwell.

Radiotelegraphy advanced from the experimental to the practicable stage at the turn of the century. In December 1901, Marconi spanned the Atlantic Ocean with a radiotelegraphy signal, which was transmitted from Poldhu, Cornwall and received near St. John's, Newfoundland.

After Marconi's demonstration, radio was used mainly for maritime telegraphy. Its value to the safety of shipping was forcefully brought to public notice in January 1909,

when the liner "Republic" was rammed in a fog and sunk off Nantucket Island. Thanks to the wireless call for help, all but six on board were saved. To-day, to ensure safety of life at sea, certain passenger steamers and cargo vessels, by international regulation, must carry radio equipment manned by competent operators.

The early transmitting circuits used were not tunable. Sir Oliver Lodge's controllable tuned circuit made possible the existence of the many stations we have today, because each can, by this means, keep on its allotted frequency within rigorous limits.

Early radio transmitters and receivers did not use vacuum tubes. Hertz's receiver was only a simple resonator. The first practical radio receiving set was the "coherer", invented by Branly in 1890, in which radiation was detected by being passed through a mass of metal filings enclosed in a non-conducting tube. Other and better means of detecting radio signals followed, all of which were superseded by the rectification method, which is still used to this day. The first form of rectifying detector used was the galena crystal, which was introduced about 1906. The crystal was followed by the thermionic valve or vacuum tube.

Fleming in England and DeForest in the United States played notable parts in the development of the *vacuum tube*. Prior to Fleming, scientists had observed the phenomenon of thermionic emission, that is, the emission of appreciable amounts of negative electricity (electrons) from a metallic body heated to a high temperature, but the principle lay dormant. Fleming found that by placing a positively charged plate near enough to the emitting body, the electrons would be attracted to the plate, and that if the circuit were completed, there would be a unidirectional flow of current. The two-electrode tube or "diode" developed by Fleming thus permitted rectification and was used for the reception of radio signals. DeForest markedly improved the vacuum tube by inventing the three element tube or "triode". He found that by placing a metal mesh or grid element between the plate and filament of a diode, the electron flow could be controlled by very small variations in grid voltage. DeForest

showed that the triode could be used for other purposes besides rectification. In the new circuit designs which followed, the triode was used as an oscillator, detector, amplifier and modulator. Later developments in thermionic tubes were the tetrode (four elements) and pentode (five elements), and still later combination tubes, in which one tube performed the functions of several.

The thermionic tube not only had a profound effect on radiotelegraphy, but also on *radiotelephony*. It was largely due to its development as a modulator that radiotelephony became practicable. In 1915, United States telephone engineers gave the first public demonstration of radiotelephony, transmitting directly from Washington to Paris and to Honolulu. During World War I, radiotelephony communication was used on aircraft and ships. Ship-to-shore radiotelephony was successfully established in 1920 and 1921. In 1928, a regular radiotelephone service between New York and London was put into operation. Today it is possible to communicate by telephone with almost all parts of the world, and with passenger ships, trains, etc., equipped with radiotelephone apparatus.

It was not until radio broadcasting came on the scene in 1920, that public interest in radiotelephony was stimulated. Up till then, radio was used for private communication purposes. Broadcasting, on the other hand, permitted the dissemination of information and entertainment to many people at one time. On November 2nd, 1920, station KDKA, Pittsburgh, broadcast the Harding-Cox election returns to an audience of several thousand who listened in on home-made crystal receivers. Radio stations sprang up almost overnight, in both the United States and Canada. Today radio broadcasting reaches millions of listeners, and through networks of stations, linked by landlines and by trans-oceanic radiotelephony, a single programme can be heard the world over.

In the decade of 1920-30, it was found that *shorter waves*, previously considered of little practical use, were superior to long waves in many respects — less power was required to cover the same distance, beam transmission became possible, inter-channel interference was reduced, and keying could be speeded up in radiotelegraphy. As the

number of stations and services increased, more and more channels were required. The use of higher frequencies (shorter waves) alleviated this problem. The use of ultra-short waves made frequency modulation (FM) and television practicable. Radar, which accomplished so much in the detection of enemy aircraft, in gun-laying, bombing, and in navigation during World War II, would not have been possible without ultra-short waves. The application of higher frequencies was accompanied by the development of new materials, circuits, antennae, and special purpose thermionic tubes.

The invention of the *photo-electric cell* took radio another step forward. It has provided the best basic means, so far, of converting light values into electrical impulses of varying strength, which impulses can be transmitted, received and retranslated into the original values of light and shade. One of its first uses was in the transmission by radio of photographs and of printed or written documents. This method of reproducing pictures, print or any other stationary image, is also known as *facsimile*. A more recent development of facsimile makes it possible for the contents of a newspaper to be broadcast from a central point and printed within the homes of subscribers. The most significant application of the photo-electric cell, however, is in *television*, where sight has been added to sound. By means of the television camera, which incorporates an electronic "scanner" acting on many photo-electric cells, moving images can be transmitted. Greater image clarity was achieved by a highly sensitive camera tube, called the "image orthicon", which was developed in 1945. Also deserving mention are the "cathode-ray tube" or "kinescope" and its associated "video" circuits, which, at the receiving end in television and radar, convert electrical impulses into light energy which can be seen (hence "video").

Since about 1930 electronic tools have been applied increasingly to the industrial process, and to the medical and scientific fields. The application of electronics to industry has resulted in greater precision, speed and safety, and an improvement in products and processes. In industry alone, the thermionic tube has been put to

literally thousands of uses. It is used to control and regulate machines and processes, to sort, measure, match, count and weigh, to inspect and detect, to heat, and to protect workers, plant and equipment. For example, dielectric heating is used to speed the manufacture of penicillin and plastics, the bonding of plywood, the vulcanizing of rubber and the processing of tin. X-ray machines are used to detect faults in machine parts and castings. Complicated business machines, electronically controlled, tabulate and calculate much faster and more accurately than was ever possible by human beings.

The electron microscope, which permits the observation of viruses and other minute particles of matter which could not be seen through optical microscopes, has extended the boundaries of science and medicine. The electronic stethoscope, cardiograph, X-ray machine and fluoroscope are other examples of electronic apparatus used for diagnostic purposes in medicine. In the atomic energy field, the cyclotron, betatron, and geiger counter (also important in prospecting), among others, are electronic instruments. The science of meteorology has become more precise through the use of radio instruments.

The success of modern commercial aviation depends greatly on the stable operation of its ground and air radio apparatus. Radio communication is maintained between aircraft in flight and ground stations, and from ground station to ground station. Aeroplanes are guided through fog and storms by radio beams. Instrument-landing equipment permits the pilot to bring his craft to earth in fog, and direction-finding apparatus gives him his position when landmarks are invisible. Other equipment in use, or being developed, includes collision warning devices, automatic aircraft position reporters, traffic clearance indicators, and absolute altimeters. New developments in ultra high frequency radio, including radar, will give greater ground control over larger numbers of aircraft, which is essential to the future expansion of civil aviation.

Electronics is used for communication in the protective services, in fire prevention, in the protection of

forests, and in public utilities. Traffic controls, burglar alarms, public address systems are other uses, to mention only a few. The Federal Government provides radio aids to navigation for inland and sea-going vessels and for aviation; and all manner of radio and radar equipment is used in the armed services for defence purposes.

II. BROAD FIELD OF WORK

The scope of this monograph is confined to the main technical occupations in the broad functional areas of research and development, manufacturing, radio operation and radio servicing.

In Canada, *research and development* are carried on mainly by manufacturers, by certain agencies of the Federal Government (National Research Council, Defence Research Board, and others), in radio broadcasting and in some of the universities. In this relatively small but select field are to be found professional electrical and radio engineers, and highly skilled radio technicians.

The *manufacture* of radio and electronic equipment is an expanding industry in Canada. About three-quarters of the production workers in this field follow such occupations as assemblers and wirers, coil winders, aligners, testers, inspectors, and trouble shooters or repairmen. A good part of the work is done on a highly mechanized basis and requires only a very limited skill.

Occupations in the *operation and servicing* of radio equipment form two important groups in the radio and electronics field. They are occupations which, unlike many of the jobs in manufacturing, require a specific vocational training before entry.

The Department of Transport defines a *radio operator* as a "person employed, engaged or authorized to operate or assist in the operation of any radio transmitter, radio receiver, or other apparatus at any coast, land or mobile radio station". Commercial broadcasting stations and the Department of Transport are the largest employers of radio operators, followed by the merchant marine and commercial air lines.

The occupations of *radio repairman, radio serviceman, radio mechanic* and *radio technician* are closely related in that they all have to do with the testing, repairing and servicing of electronic equipment. These terms will be used interchangeably in the course of this monograph.

The largest field of employment for this group of workers is in the servicing of *home radio and television receivers*. The majority of them are employed in radio repair shops, either as owners or workers. Others are employed in the manufacture and testing of radio and electronic equipment, in radio broadcasting, in the servicing of industrial, commercial and scientific electronic equipment, in national defence and other fields.

The spread of *television* in the United States has already made itself felt on the radio manufacturing industry in Canada, with promise of considerable further expansion when a Canadian television network is set up. The influence of television on radio and electronics occupations will be discussed in other sections of this monograph.

III. RADIO OPERATORS (Certificated)

There is some overlapping of function between the radio operator and the radio repairman, technician or serviceman, in that both are required to maintain and remedy faults in radio equipment. The main function of the operator, however, is either to receive and transmit messages by radio telegraphy or telephony, or operate various kinds of radio apparatus as in radio broadcasting. The repairman, on the other hand, is wholly concerned with repair and maintenance work.

There is another distinction. The operator, unlike the repairman or mechanic, must, with certain exceptions, be certificated by the Federal Government; that is, hold a regular Canadian Certificate of Proficiency in Radio. Radio operators on private commercial broadcasting stations, however, do not require a certificate at the present time. Some stations, however, give preference to certificated operators. This latter group will be dealt

with in the section "Technical Occupations in Sound and Television Broadcasting".

The duties of radio operators vary according to the type of station on which employed.

MAIN TYPES OF STATION AND CERTIFICATION REQUIRED

Certificated operators are required mainly on Department of Transport and Canadian Marconi stations, on ship stations, and on aircraft and ground stations in civil aviation.

The Department of Transport controls *radio coast stations* on the east and west coasts, on the Hudson Bay and Strait, and on the Great Lakes.[1] The primary purpose of these stations is to provide radio communication with ships at sea. The Department operates *radio direction-finding stations* which aid ships and aircraft to establish their bearings. A large number of *radiobeacon stations*, which enable ships or aircraft equipped with direction-finders to determine bearing or direction, operate on the east and west coasts and on the Great Lakes. *"Loran" stations* provide a long-range aid-to-navigation service.

Radio aids to air navigation are provided by the Department of Transport from coast-to-coast, along the airways used by Canadian and United States air lines and military aircraft. *Radio range stations* form the principal aid. These are located about 100 miles apart and transmit radio beams which guide aircraft in flight. Many of these stations are equipped with radiotelegraph and radiotelephone equipment, by means of which pilots are given weather and other information. *Instrument landing* equipment, used on some aerodromes, enables pilots to land aircraft under conditions of very low visibility.

Weather reporting stations function at strategic points throughout the country.

Many Department of Transport radio stations are in isolated areas, and, consequently, require the type of

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[1] The Canadian Marconi Company operates nearly all the ground-to-ship, or coast stations, on the Great Lakes for the Department of Transport. They also have some shipping companies under contract for the supply of radio operators.

individual who is willing and able to endure the hardships and isolation associated with such stations. The Marine Section, for example, has stations dotting the Hudson Bay and Baffin Bay regions, and the Aviation Section has stations in Labrador, the Northwest Territories, and up to within 500 miles of the North Pole. Radio operators are usually required to spend from twelve to fifteen months on such stations, with the possibility of having to return there at some later date. On the brighter side, the payment of isolation allowances and the recent provision of free board and lodging at these stations provide radio operators with an excellent opportunity of building up a small stake in life.

The entrance requirement for radio operators on Department of Transport stations is either a First or Second Class Certificate.

There are two broad classes of *ship stations* which require radio operators: ships which, by law, have to carry a radiotelegraph installation for safety purposes, and ship stations which handle public correspondence. In the first class, as a general rule, ocean-going passengers and cargo vessels over a certain tonnage carry a minimum of two operators, others only one; inland and coastal ships carry one operator. In the second class, "first category ship stations" carry two operators, others only one. Where there are two operators, the one in charge must hold a First Class Certificate; in other cases the operator must hold at least a Second Class Certificate. The great majority of inland and coastal ships, equipped with radiotelephone equipment only, do not carry radio operators.

In *civil aviation*, radio operators are not used on aircraft making overland flights, whether inside or outside of Canada; the radio equipment is operated by the pilot, who must hold a Radiotelephone Operator's Restricted Certificate. Aircraft making overseas flights do, however, carry flight radio officers (there are only a small number of such operators) holding either a First or Second Class Certificate. Radio operators possessing a Radiotelephone Operator's General Certificate are employed by air lines on ground radio equipment.

There are many stations on land which do not require the services of certificated operators. Broadcasting stations have already been mentioned in this respect. Radio operators employed by the Canadian railroads for landline work and for communication between various stations also do not require certification. Special training for these jobs is normally provided by the railroad companies. Provincial government stations used for forestry, police and other purposes, municipal stations used by police and fire services, private stations operated by mining companies, taxi companies and others, public and private utilities radio stations — on all these stations and others certificated operators are not compulsory.

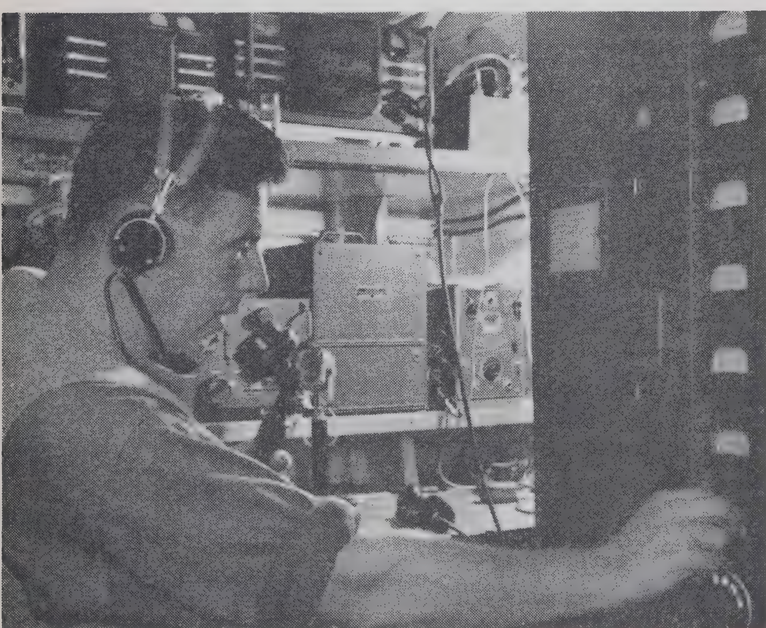

Photo N.F.B.

Ship radio officer tunes transmitter

NATURE OF WORK

Some indication of the nature of work of radio operators on Department of Transport Stations has already been given.

In general, a First or Second Class radio operator on a ship or coast station is required to transmit and receive messages by radiotelephone and radiotelegraph. In radiotelegraphy, he transmits and receives in International Morse Code. He uses or maintains direction-finding apparatus in order to obtain bearings; adjusts, operates, maintains and repairs radiotelegraph, radiotelephone, and other electronic apparatus, including direction-finding and auto-alarm devices; adjusts, operates and maintains accessory apparatus, such as motor generator sets and storage batteries. He computes, collects and accounts for tolls on messages, and maintains a record of messages handled.

Flight radio officers are responsible for the transmission and reception of communications by radio aboard an aircraft and must be able to locate and correct minor equipment faults. Ground radio operators provide point-to-point communication between ground stations by means of radio and teletype and communicate with aircraft. They are also required to make elementary repairs to the equipment, possess a working knowledge of meteorology, and a good general knowledge of station functions and organization. On a number of airports in Canada, usually of the smaller kind, the operator may also perform the work of an agent or despatcher, in which case he is called an operator-agent or operator-despatcher.

QUALIFICATIONS

Alertness, good memory, hand and finger dexterity, and the ability to work under pressure at high speed are general qualifications.

To obtain a Certificate of Proficiency, operators must be British subjects, must not be less than eighteen years of age, and must have hearing of not less than 75 per cent of normal.

To qualify for a First Class Certificate, a candidate must have had at least one year's experience as a radiotelegraph operator on board a ship or on a coast station.

Specific requirements for each type of Certificate are outlined in Regulations under "The Radio Act, 1938" and amendments thereto.

In the Department of Transport, radio technicians are promoted from the radio operator classification, and unless the radio operator has a good grounding in the principles of radio and electronics, his chances of such promotion are greatly lessened. At the present time, it appears that more and more such radio technicians will be required, because the radio equipment used by the Department of Transport is becoming more complex and diversified each year. A good basic knowledge of principles is of the utmost importance also to radio operators in other fields.

TRAINING

Day and evening courses in radio operation are given in Canada by a small number of private trade schools and provincial vocational schools situated in the larger centres. Home-study courses are also available at private radio schools in Toronto and Vancouver. The following is a list of schools which are currently (March 1951) engaged in preparing students for Certificates of Proficiency:

Vancouver, B.C.

Sprott-Shaw Radio School
Radio Electronics Centre
King Edward High School

Calgary, Alta.

Provincial Institute of Technology and Art

Moose Jaw, Sask.

Moose Jaw Technical School

Toronto, Ont.

Radio College of Canada
Central Technical School

Saint John, N.B.

Saint John Vocational School

The length of training time necessary depends upon the individual's ability to master the requisite theory and practice and to reach the minimum speeds in message sending and receiving required for a particular certificate. Private trade schools stipulate a minimum of eight to nine months' full-time attendance.

High school courses in mathematics — algebra, trigonometry and geometry — and in physics provide a valuable preparation for the would-be radio operator. Technical school courses in electrical and radio theory and practice are especially useful.

EMPLOYMENT OUTLOOK

In a survey conducted by the Department of Veterans Affairs early in 1947, it was estimated that there were then about 1,300 radio operators in Canada (excluding operators in radio broadcasting), distributed as follows:

Department of Transport	**600**	**radio operators**
Merchant Marine	**400**	" "
Commercial Air Lines	**200**	" "
Other fields	**100**	" "

Prior to 1939, the supply of radio operators exceeded the demand. During World War II, the situation changed drastically and demand far outstripped supply. Many operators were trained in the emergency, the Department of Transport issuing about 1,200 to 1,400 certificates annually during the war years. With the ending of hostilities, the need for such a large number of radio operators in the merchant marine, the armed forces, and the Department of Transport disappeared. Demobilization,

the immediate post-war reduction of mercantile shipping, and the lessened requirements of the Department of Transport, released many operators for other employment. With the resumption of peacetime activities, merchant ships were permitted to carry fewer operators than in wartime, which further increased the already great supply of radio operators.

In all probability, many radio operators, through force of circumstances, have had to gain employment in other fields. The enrolment of students preparing for Certificates of Proficiency at the various radio training schools had declined considerably — at the present time, there are only about 300 students being trained in Canada. This has tended to bring the supply of radio operators in better balance with demand.

At the present time, there is a need for radio operators in the Department of Transport, as the result of expansion and turnover factors.[1] The present operator strength of the Department is about 1,050. The number of operators with commercial airlines has, in all probability, increased since the time of the D.V.A. survey, because of expanded operations. Continued expansion would likely result in a further, though moderate, demand for radio operators. Growing defence needs will likely add to the demand for operators in the services, but not necessarily for certificated operators. Another emergency would, of course, highly inflate demand. Barring such a contingency, it would appear that a greater number of openings for certificated personnel will be occasioned by turnover rather than expansion.

The increasing use of radiotelephony on ships and other stations for message sending and receiving has tended to limit the need for radio operators; the use of radioteletype in aviation and other fields has had a similar effect.

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[1] The Department of Transport recently advertised for "student radio operators", who will be trained at approved Canadian schools from September 1951 to April 1952. They will be paid $125 a month during training plus tuition fees, and will be immediately employed as radio operators on successful completion of training.

IV. TECHNICAL OCCUPATIONS IN SOUND AND TELEVISION BROADCASTING

There are three main groups of technical workers both in sound and television broadcasting: operators, technicians or mechanics, and professional engineers. The first group is the most important from the point of view of numbers employed. Operators in radio broadcasting are frequently erroneously called "engineers" (sometimes "technicians") even though, in most cases, they are not professionally qualified.

SOUND BROADCASTING OPERATORS

The work of the operator is usually of a specialized nature on large stations, but more general in scope on small ones. Where it is specialized, the degree of technical knowledge and skill varies as between jobs — some jobs requiring a high degree of skill and fairly advanced technical knowledge, others a lesser degree of skill and a more general knowledge of radio theory and practice.

The operator has his function at each stage of the broadcasting process. A radio programme originates in a broadcasting studio, which has adjoining it a control-room. The *studio or control-room operator* advises and assists the producer, from a technical standpoint, in planning and producing studio programmes. He is responsible for the management and operation of all studio and control-room technical equipment and accessories, such as microphones and amplifiers. During a broadcast, he operates the control-room equipment, blending or "mixing" together the outputs of the individual microphones by means of individual volume controls, observing the over-all effect on a monitor loudspeaker, and maintaining the level of transmission within predetermined limits. He should be thoroughly familiar with turn-tables and recordings. The studio operator may do maintenance and repair work, and may perform the duties of master-control operator, transmitter operator, field operator or recording operator.

The master-control or switch-bank desk is the focal point of a radio station. All programmes, whether they originate outside or locally, are fed through the switch-bank desk to a station's transmitter; in the case of a network central station, the programme will also be fed via the master control to other stations on the network through landlines operated by a wire company. These operations are performed by the *master-control operator*.

In a large broadcasting plant, the master-control operator is usually a senior person. He is required to have a full understanding of standard broadcast network procedure and of traffic procedure in his own plant, as well as of all radio facilities used for the transmission of network programmes. A sound knowledge of transmission circuit theory and practice is also required.

A *transmitter operator* operates and maintains the transmitter and accessory equipment (including aerial systems) in accordance with standard procedure. He monitors the transmission continually, and closely examines equipment to prevent and detect faults. If faults occur, he must locate and repair them with a minimum loss of time.

A fairly high level of technical knowledge, not only of transmitters and radiation systems, but of other types of broadcasting equipment, is required of the transmitter operator.

A programme may originate at a point remote from a station. Examples of this are "special events" programmes — sports, on-the-spot broadcasts of any event of general interest. Portable equipment, such as microphones, amplifiers and short-wave transmitters, is used to bring such programmes to the listener. The *field operator* installs, tests and operates the portable equipment. Where telephone lines are available, the equipment is connected with the station's master-control desk through this means. Where there are no telephone facilities, mobile short-wave transmitters are used. The broadcast is received at the station by short-wave receiver and then fed to the regular transmitter through master control. Sometimes the field operator also has to perform

on-the-spot radio announcing. He may also record the broadcast in the field for later use. A sound technical knowledge, which should include audio facilities and various types of transmission, is required of the field operator. (Studio operators also frequently perform field operating work).

The *recording operator* operates recording equipment for the purpose of preparing records of broadcasts, auditions, or rehearsals for the use of a station. The job calls for a full technical knowledge of recording equipment.

A *general operator* may do several or most of the foregoing functions, depending on the size of the station and operating staff. On small stations, he is also required to do some announcing.

The entry occupation for the beginner is that of *learner*. As such, he learns under the guidance of experienced operators the various operational functions of radio broadcasting.

TELEVISION BROADCASTING OPERATORS

The occupations described in this section do not exist in Canada as yet, but will do so in the very near future. The descriptions used are based on television practice in the United States, and since broadcasting techniques in Canada generally parallel those in that country, the descriptions can be considered as having at least a general validity for Canada.

Live television programmes originate in studios which resemble motion-picture studios. Cameras are usually mounted on "dollies" enabling them to be moved rapidly from one position to another — in this way, varied views of the set and actors are obtained. The cameras are connected by flexible cables to the control-room, where the pictures are viewed and co-ordinated.

Sound is picked up by special microphones which hang suspended from large rods or "microphone booms".

Television programmes also consist of the televising of sound motion-picture films. In the projection-room,

Photo N.F.B.

Control room in television broadcasting

film is run through a special projector which throws the moving images on to the surface of a television camera tube. The corresponding "video" signals produced by the camera are sent from the projection-room to the control-room.

Programmes may also be in the form of "remote pick-ups".

Whether a programme has originated in a studio, on film, or at a remote point, it is co-ordinated in the master control-room by the producer. Here pictures from the various studio cameras, or from the film projector or remote pick-up point, appear on different monitoring picture tubes. The producer selects the desired picture, which is switched to the transmitter by the control-room operator.

In transmitting, picture signals are sent on one frequency while sound signals are simultaneously sent on another nearby frequency. The picture transmitter is far more complex than ordinary radio transmitters. It sends not only picture signals but also synchronizing signals, which enable receivers to reconstitute the picture in proper sequence.

Television broadcasting is a more complicated process than ordinary sound broadcasting from an operational point of view, because of the addition of sight to sound. On the sound or "audio" side, operational techniques are quite similar in both media; on the "video" or sight side, new operating techniques arise. Television broadcasting requires many more persons on technical (and programme) staffs than does ordinary radio broadcasting.

The entry occupation for the operator is that of *learner*, who assists in the operation of sound and sight television equipment. Some learners are selected from among sound broadcasting men; others come directly from the better radio and television schools.

The *video camera operator* has duties similar to those of a motion-picture cameraman. He must have a knowledge of lenses, lighting angles, optics and electronics. Motion picture experience, such as newsreel and documentary, is desirable.

There are two classes of studio operator in television, one for "video" and the other for "audio" work. The *video studio operator* is responsible for the control, adjustment and transmission of picture signals. He operates video equipment to control picture detail, shading, synchronization of signals, and adjustment of picture level. He may do "camera switching". He also gives technical advice and assistance to the producer in the production of studio programmes. The *audio studio operator* has much the same duties as his counterpart in ordinary sound broadcasting.

The *television studio and field microphone operator* adjusts microphones to varying perspective requirements during rehearsals and broadcasts.

The *transmitter operator* maintains and operates all the transmitting equipment at a television station. The transmitters and aerial systems used differ radically from those found in sound broadcasting.

The *field operator* has duties similar to those of his opposite number in radio broadcasting, except that he has to be familiar with both video and sound aspects of remote broadcasting.

The *projection-room operator* operates 16mm. and 35mm. sound and still projection equipment; takes, prints and enlarges pictures; projects lantern slides on the television camera tube and runs feature films through the television system. Licensed motion-picture projectionists are preferred for this job.

QUALIFICATIONS AND TRAINING FOR BROADCASTING OPERATORS

Certain qualifications are common to most operational jobs—ability to work well under pressure (of prime importance), dependability, resourcefulness, good judgment, artistic sense (especially for studio operation), and a pleasing personality.

A detailed listing of specific technical and other requirements for the different kinds of broadcasting operators is not practicable here. Some idea of these can

be had from the following general statement of requirements for general operators in sound broadcasting: *Educational Requirements* — vary from three years' high school to senior matriculation, plus one or more years of technical studies in electricity, radio and allied fields. *Working Knowledge* — one to four years' experience (depending upon the job) in any or all types of technical broadcast operating. *Physical Requirements* — normal eyesight and hearing, good general health and sufficient physical strength to carry heavy equipment when required.

BROADCASTING TECHNICIANS AND ENGINEERS

There are several classes of technician employed by radio and television stations: maintenance, mechanical, and research technicians.

The *maintenance technician* has a responsible job. He services and repairs all technical broadcast equipment, including radio transmitters and receivers, amplifiers, microphones, recording equipment and reproducers, relays and electric generating equipment of all kinds. He may also construct and wire small units, such as amplifiers and filters. He must be skilled in the use of hand and small machine tools, and of such test equipment as oscillators, meters, oscilloscopes.

Analytical ability and resourcefulness are required in the maintenance mechanic. A sound theoretical training, together with a considerable amount of practical broadcasting experience, is also required. Advancement to this position is usually from either junior maintenance man or operator (preferably general operator).

A *mechanical technician* is responsible for the maintenance of all mechanical and building equipment in a broadcasting plant. Such equipment includes cooling systems associated with transmitters, heating, ventilating, refrigeration, pumping, cleaning and fire-fighting equipment. Some experience with general broadcasting transmitters and a knowledge of mechanical equipment and tools are required.

Research technicians are also employed by the CBC and large independent broadcasting companies on the development side of broadcasting. They do routine engineering work under the general supervision of an engineer but with considerable latitude for independent judgment, including testing equipment for operation and performance and assisting engineers in the details and layout of engineering work. This occupation is a highly skilled one and calls for several years' experience in production testing of communication equipment or extensive radio service work, together with experience as a maintenance technician.

Graduate engineers are used mainly on CBC stations, as well as on some independents, to direct research and development projects and to act as technical and administrative heads of operational or research departments, or of a whole plant. (CBC also has engineers as technical heads of a whole region comprising a number of stations). The engineer assumes full responsibility for the technical operation of a radio station; studies the developments in radio broadcasting and determines the merits and practicability of such developments for the station's use; develops, constructs, and installs new equipment; supervises the work of the radio operators and instructs them in operation techniques necessary for more efficient broadcasting.

These jobs call for a university degree in electrical or communication engineering plus extensive radio engineering experience in the design, production and installation of communication equipment, combined with, in some cases, administrative ability.

The technicians and engineers mentioned are also to be found on the television side of broadcasting, where they perform similar duties on television sound and sight equipment.

EMPLOYMENT OUTLOOK

Sound Broadcasting

Radio broadcasting in Canada is operated (1) as a national public service by the Canadian Broadcasting

Corporation, and (2) under private ownership by independent stations. The Canadian Broadcasting Corporation (CBC) operates and controls all network broadcasting in Canada, and the operations of the privately owned stations are directed to local community service. The CBC operates, as fiscal agent for the Government of Canada, an International Shortwave Service broadcasting in fourteen different languages to other countries.

As of April 1, 1950, there were 148 standard band broadcasting stations in Canada — 130 were operated by private owners, 18 by the Canadian Broadcasting Corporation. In addition, the CBC owned and operated a number of low power relay broadcast transmitters in remote areas. There were also 36 frequency modulation broadcasting stations (5 CBC, 31 private), and a number of shortwave broadcasting stations, the majority of which were operated by the CBC. Although there has been a considerable growth in the number of FM stations over the past three or four years, this form of broadcasting has not added greatly to the number of technical personnel, for the reason that FM stations, with a few exceptions, are permitted at present to operate only in conjunction with AM stations; i.e. stations combining AM and FM broadcast the same programme over both channels. As a result, the same technical personnel can, to a great extent, service both channels.

According to the 1941 census, there were then 2,575 persons gainfully occupied in the radio broadcasting industry. Technical personnel, numbering 827, made up 32 per cent of this figure. A breakdown of this group by occupation shows the following:

TECHNICAL PERSONNEL IN RADIO BROADCASTING INDUSTRY BY OCCUPATION, JUNE 1941

Occupation	Male	Female
Radio station operators	483	—
Electrical appliance repairmen and mechanics	75	—
Electrical engineers[1]	269	—
Total	827	

[1] Most of these are not professional engineers.

The number of stations increased considerably from 1941 to 1950, so that the number of technical workers employed today in the broadcasting industry would be appreciably greater than in 1941. It is roughly estimated that in 1950 there were about 1,000 technical workers in radio broadcasting.

Television Broadcasting

Because of the problems involved in the establishment of television broadcasting in Canada, and the likelihood that its growth will be retarded by a growing military need for electronic equipment, the demand for technical workers in television broadcasting will, in all probability, be very limited over the next few years. Given more stable conditions, there is every reason to look forward eventually to an expanding technical working-force in broadcasting because of television.

The policy of the Government of Canada in the development and operation of television in Canada was stated in the House of Commons on March 28, 1949. Under this policy the general direction of television in Canada is, in accordance with the Canadian Broadcasting Act, 1936, entrusted to the Board of Governors of the Canadian Broadcasting Corporation who are to arrange for television operations by the CBC, and by licensed private stations.

At present the CBC is actively engaged in establishing television centres in Toronto and Montreal which will be ready for operation early in 1952. The ultimate objective is the development of a publicly owned and controlled national television network system for Canada.

Recommendations on radio broadcasting and television are contained in the Report of the Royal Commission on National Development in the Arts, Letters and Sciences. Pending action being taken on these recommendations, the development of a Canadian system of television is proceeding on an interim basis.

The present policy as regards private TV broadcasting is to give preference to applications entered by two or more private groups prepared to set up a television station

on a joint-management basis. In the control of television, the CBC also follows a policy, which is in line with its objective, of "not granting permission for individual private Canadian TV stations to become outlets for non-Canadian systems". Because of these two factors, it can be expected that private television will proceed more slowly than would have otherwise been the case.

Technical, economic, geographic and population problems are other deterrents to the rapid establishment of television broadcasting in Canada. An extensive rearmament programme would act as a brake, since it would affect the availability of electronic equipment necessary to television.

The main technical problem concerns the small number of frequencies or channels available for TV broadcasting. Present television systems utilize the very high frequency (VHF) band. Twelve channels on this band have been allotted to Canada for TV broadcasting. The ultra high frequency band (UHF), which allows for many more channels than VHF, involves new and complex technical problems, and until these are resolved television will be confined to the more limited VHF band.

By agreement between Canada and the United States, the city of Montreal has been allotted five VHF channels, of which the CBC has reserved two; three channels have been allotted to Toronto, of which the CBC has reserved one. This limits the number of VHF television stations in these two cities to eight, of which five will be privately owned and three publicly owned.

The lack of channels is more serious, as regards future expansion, in the more thickly populated areas, where towns and cities are closer together. The range of a television station varies anywhere from fifty to eighty miles, but interference as between stations on the same frequency can take place up to about 210 miles. The same channel, however, may be used in different cities, provided they are far enough apart.

The high cost of live television programmes makes a network system imperative. The problem of creating a network is almost entirely an economic one. Direct link-

ing of stations is accomplished in two ways: by co-axial cable and by micro-wave relay stations (small stations erected some twenty-five miles apart, which receive and retransmit television signals). It has been estimated that a coast-to-coast Canadian network (exclusive of operating cost) would cost anywhere from 35 to 50 million dollars. This network would have to include the thinly settled areas of Northern Ontario, the Prairies, the Maritimes and Newfoundland. Television stations can also be linked indirectly, and at lower cost, by films flown by air. These films are of two kinds: kinescope recordings of live television programmes, and films made especially for telecasting. Undoubtedly, a combination of both methods will be used in any network system.

It is difficult to say at this stage just how severe will be the impact of television on sound broadcasting. In a country as vast as Canada, where a large part of the population resides in rural areas, it is necessary that television with its limited range be complemented by sound broadcasting with its greater range. Over the long run, the likelihood is that sound broadcasting will lose ground. Especially will this be the case in metropolitan areas. However, until TV becomes fully established in Canada, it would appear that sound broadcasting, in terms of employment openings for technical personnel, will just about hold its own.

The congestion of the standard broadcasting band in the large urban areas near the United States border, and defence needs, will tend to hinder the establishment of new sound stations. The problem of congestion is less serious in Northern Ontario, in certain areas of Quebec outside of Montreal, and in the northern part of the Prairies. In these areas, present small stations may expand their facilities and thus provide a small number of new openings.

Improvements in broadcasting equipment tend to reduce the need for operators. Transmitters, for example, have been developed which permit unattended operation.

The continual movement of technical personnel from small to large stations (some also move to U.S. stations),

and the promotion of operators to production and administrative positions, contribute to a fairly high turnover of such personnel.

V. TECHNICAL OCCUPATIONS IN THE MANUFACTURE OF RADIO, TELEVISION AND OTHER ELECTRONIC EQUIPMENT

NATURE OF WORK

Manufactured electronic products can be classified under the general headings of radio, television, and radar transmitters and receivers, electric phonographs, public address and amplifier equipment, wire and tape recorders, commercial electronic equipment and related apparatus, loudspeakers, tubes, and other component parts.

Considerable research and development work precedes the manufacture of electronic equipment. This is the function of the professional electrical or radio engineer, assisted by the technician. A great part of research work has, in the past, been done by parent companies outside of Canada. There is a growing tendency today for Canadian radio manufacturers to do more of their own research and development work.

A *radio engineer* in manufacturing designs and constructs radio equipment and does necessary research and experimentation, such as developing tubes, condensers, loudspeakers, and receiving and transmitting equipment. The research work involves such problems as mathematical analyses of electric and radio circuits, and the study of electrical effects. Design and development include the economic application of the discoveries of the research worker. As a *designer*, the radio engineer creates designs for radio equipment; writes specifications; gives advice on construction, manufacture, materials and processes; establishes minimum acceptable standards of performance; also redesigns equipment to keep abreast of engineering progress.

There are three main stages in the actual production of electronic equipment: the manufacture of parts, the assembly of parts into various pieces of equipment, and testing and inspection.

The *manufacture of parts* has become a highly mechanized process. Machines have been developed for the manufacture of almost every part of electronic apparatus, each machine requiring its individual operator. In many cases, the worker merely feeds raw material to the machine and ensures that no stoppage occurs. In very few of such jobs does the work require more than a short period of in-plant training.

There are three main stages in the *assembling process*. There is the mechanical assembling of parts to form

Photo N.F.B.

Assembly workers putting finishing touches to radar sets

units or sub-assemblies. Certain parts which are made by machine, such as paper condensers, form a complete unit in themselves. Many other parts have to be assembled to form a unit or sub-assembly. For example, speakers, tubes, coils, transformers, and tuning-condensers are made up of several parts.

The next stage in the assembling process, also of a mechanical nature, is to mount the units and sub-assemblies on a chassis or panel, using hand tools, such as screw drivers, wrenches, files and pliers.

The third stage is to wire the various components. Workers doing this operation are known as assemblers or wiremen.

Assemblers are usually designated according to the part worked on or stage of assembly; e.g. transformer assembler, coil assembler, condenser assembler, tube assembler, chassis assembler.

At one time assembly work required considerable skill. Now, however, this work is broken down into a number of relatively simple, specialized operations, generally of a semi-skilled nature. This is illustrated in the assembling of the chassis of a radio set. The bare chassis passes first to a "short" line, where the work is passed from hand to hand instead of on a conveyor belt (since the time of each operation varies), each worker inserting a part. Rivetters fix the tube sockets, lugs and miscellaneous brackets in place. Then successive operators install coils, transformers, variable condensers, controls and other large units, after which the set is ready for wiring and the installation of smaller parts. The larger parts are fastened by rivets, bolts or solder. For wiring, the partly completed chassis is placed on a conveyor belt. Each operator wires one or more components with pre-cut wires or inserts and connects smaller parts (e.g. resistances, condensers), repeating the same operation with each set. At the end of the line the chassis passes through several more operations — testing, checking, adjusting, and aligning, which are not part of the assembling process.

Not all assembling operations are of a semi-skilled nature. Some are complex. For example, the mounting

of sub-assemblies on a panel or cabinet with the aid of blueprints requires both considerable training and skill.

From the time the raw material is received in the factory until a piece of radio equipment is completed, numerous *tests and inspections* are made at each stage of the manufacturing process. Raw materials undergo physical and chemical tests; manufactured parts are tested for defects by visual, mechanical or electrical means; inspection is done at each stage of the assembly process and final tests are made on the end product. Testers and inspectors are designated according to the part worked on or stage of operation checked.

Many of the jobs in inspection and testing are routine in nature, such as attaching a part to a testing-set and observing how far a pointer swings, testing a set for poor wiring or a coil for uneven windings, or carrying out simple tests on intermediate and radio-frequency stages. Such jobs require only a very short in-plant training period. Other jobs require more skill and a sound technical training.

Two of the most skilled occupations in this field are *receiver tester* and *transmitter tester*. A completed chassis, for example, passes through their hands for final check. These men may also make final checks on other types of electronic equipment.

The skilled *receiver tester* checks completely the assembly, wiring and parts of radio receivers and adjusts them to meet specifications. To do this he uses a variety of measuring and testing instruments. He studies blueprints and specifications and decides on testing procedure; makes inspection for mechanical defects, prodding and twisting parts for looseness; makes continuity test of wiring; measures tube voltages and determines and adjusts any faults; uses special instruments, such as test oscillators, oscillographs, output meters, and frequency meters; takes instrument readings and plots curves over frequency ranges. He may locate causes of trouble and correct by repairing, rewiring or replacing parts.

This work may be broken down into specializations. The *electrical tester*, for example, specializes in continuity

testing; the *radio chassis aligner*, in the aligning of intermediate and radio-frequency stages; the *trouble shooter*, *repairman*, or *mechanic*, in the locating and repairing of faults.

The *transmitter tester* performs various tests on and adjusts radio transmitting equipment to conform to specifications, using specialized test instruments, such as wave analyzers, oscillographs and distortion meters. He examines and checks electrical circuits for defective units and wiring, according to blueprints and schematic diagrams; ascertains characteristics of transmitter, such as frequency stability, distortion, fidelity, and power output; records all data and makes calculations; marks defective parts for repair by appropriate departments; may test the transmitter for performance under varying conditions of humidity, temperature, shock and vibration.

This work also may be broken down into specialized operations.

QUALIFICATIONS AND TRAINING

The majority of jobs in the manufacture of parts, in the assembling process, and in testing and inspection, require only a brief period of training on-the-job, and call for mechanical aptitude, good eyesight, and manual dexterity. This last qualification is especially important in assembling, where small objects must be handled deftly and delicate adjustments made quickly and dexterously. The more skilled occupations in mechanical assembling, which call for similar general qualifications, require a longer in-plant training period.

The skilled occupations in electrical testing and inspection necessitate a sound pre-entry training in electrical and radio principles, acquired either at a public technical school or private trade school, complemented by in-plant training. The same is true for technicians in research and development.

Electrical or radio engineers require a minimum of a bachelor's degree in electrical engineering, with specialization in electronics.

EMPLOYMENT OUTLOOK

An average number of 7,363 employees were engaged in the manufacture of radio equipment and parts in 1949.[1]

It is estimated that approximately 62 per cent, or 4,600, of these workers were engaged in actual production work and engineering. Assemblers, including wirers, comprised about half of the production workers, whereas those in the more highly skilled technical occupations accounted for only 20 to 25 per cent of the total.

The approximate distribution of production workers by occupational group, expressed as a percentage of the estimated 4,600 production workers, is shown in the following table:

Occupation	Percentage
Simple assemblers	27.0
Assemblers and/or wirers	18.0
Assembly fitters	4.5
Aligners and testers	5.0
Mechanical inspectors	4.0
Electrical inspectors	5.0
Line supervisors	3.0
Trouble-shooters or repairmen	4.0
Test engineers and inspectors	2.5
Other production workers	27.0

The value of production in the radio manufacturing industry in 1949 amounted to about 51.5 million dollars. Based on value of production figures, it is evident that the largest field of employment for radio and electronics production workers is in the manufacture of radio and TV receiving sets. In 1949, radio receivers for civilian use accounted for close to two-thirds of the total production in this industry; radio transmitters for civilian use for over 6.5 per cent; and vacuum tubes for about 7 per cent.

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[1] Source: Dominion Bureau of Statistics Report, "The Electrical Apparatus and Supplies Industry, 1949".

The manufacture of radios and radio parts in Canada is largely concentrated in the provinces of Ontario and Quebec, where the main centres are the Toronto and Montreal areas. Other important centres in Ontario are Hamilton, Belleville, London, Guelph, and Kitchener. Radio manufacturing is also carried on in Halifax, Winnipeg and Vancouver.

Women workers in appreciable numbers are to be found on the production side of this branch of manufacturing, because of the large amount of light assembly work involved and the hand and finger dexterity required. In the whole electrical apparatus and supplies industry in 1949, women accounted for about 37 per cent of all production workers. The proportion in radio manufacturing would be even greater.

Owing to the diversion of electronic equipment to the armed services, the production of radio sets for civilian use declined rapidly during the war years, dropping from 485,000 units in 1940 to nil units in 1944. Production for civilian use was resumed in 1945 and reached a peak of over 984,000 sets in 1947, dropping in 1948 to 639,500 sets. Business picked up again in 1949, when over 800,000 sets were produced; on the basis of producers' sales of receiver sets for 1950, it would appear that production in that year was even greater than that of 1949.

The manufacture of television receivers in Canada is already showing signs of becoming a thriving industry. As at June 1, 1951, there were seventeen Canadian companies making television sets. In addition a number of component parts manufacturers were producing parts for these. Receivers are already very largely made up of parts produced in Canada. Picture tubes made in this country are being exported to the highly competitive United States market.

Up to the end of 1949, about 8,200 TV receivers were sold in Canada.[1] In 1950, the Dominion Bureau of Statistics recorded producers' sales of 29,600 TV sets, valued at 13 million dollars. In dollar terms, television sets

[1] Source: Radio-Television Manufacturers Association of Canada.

accounted for about 18 per cent of total producers' radio sales in 1950, although in physical volume terms it represented only 4 per cent. Of the 29,600 sets, all but 317 were sold in Ontario. This is accounted for by the proximity of many Ontario residents to United States television stations. By June 1, 1951, approximately 60,000 TV receivers had been sold in Canada[1].

At present the market for television sets is limited to that part of the population living close to the international boundary within range of American TV stations. Estimates of the size of this population vary anywhere from 1.5 million to 2.5 million people, the heaviest concentrations being in southern Ontario and in the Vancouver-Victoria area.

The opening of television stations in Montreal and Toronto, expected early in 1952, would further expand the market considerably, as would the establishment of other stations later on. But the full expansion of the television industry in Canada will only be realized when a national network comes into being. Because of rearmament needs, this will take longer than would have ordinarily been the case.

It is expected that, over the next several years, the industry will be busily engaged in filling defence orders for electronic equipment, particularly radar, not only for Canada but also for the United States and other allied countries. Substantial defence orders have already been placed, and the industry is anticipating a much expanded programme.

What does all this mean in terms of employment opportunities? Combined military and civilian needs would tend to make for a greater demand for workers in this industry. Any curtailment in production for civilian use is likely to be more than offset by increased production for military purposes; thus the working-force in this industry will tend to increase. A return to more peaceful conditions would allow television manufacturing to expand at a more rapid rate. This would help the industry

[1] Source: Radio-Television Manufacturers Association of Canada.

to retain many of its workers no longer needed for defence production, and possibly even to increase its working-force.

VI. OCCUPATIONS IN SERVICING OF ELECTRONIC EQUIPMENT

The occupations primarily concerned with the servicing, testing and repairing of electronic apparatus are all closely related. The trouble-shooter or radio repairman and the skilled radio tester and inspector in radio manufacturing, the technician or mechanic in radio and television broadcasting, the radio repairman or serviceman employed in community radio repair shops, in garages, or in the servicing of industrial, commercial and scientific electronic apparatus, and even the radar technician all have the same general functions. There are differences, however, in skill and knowledge required and in types of equipment worked on in each case.

Since servicing, testing and repairing occupations have already been described in the fields of radio manufacturing and broadcasting, we shall confine ourselves here to the work of the radio repairman or serviceman in other fields.

RADIO REPAIR SHOP WORK

Community radio repair and servicing represents the largest field of employment for radio repairmen. The majority of them either operate their own service shops or work as employees in such shops. They are also employed in the radio departments of music stores, departmental stores, and in the larger automobile repair garages. A good number of radio repairmen follow this occupation part-time only.

A worker in this field may repair radios, public address systems, electric phonographs or other electronic devices. Working from circuit diagrams, he tests diverse types of circuits, tubes and other parts, using various meters,

signal generators and other instruments; isolates faults and either repairs or replaces defective parts; may install or service radio sets, aerials or other equipment in residences, business establishments and in motor vehicles (major repair work is usually done in the shop); may sell radios and household electric appliances and also service the latter. In the course of his work, the radio serviceman uses such hand tools as pliers, cutters, screwdrivers, wrenches and soldering irons.

The radio repairman in business for himself also has to do his own advertising, estimate costs of labour and materials, purchase supplies, keep records and supervise any employees he may have.

Television servicemen have duties similar to the above, except that their work is more complex, involving the servicing of "video", as well as orthodox, radio circuits.

SERVICING OF INDUSTRIAL, COMMERCIAL AND SCIENTIFIC ELECTRONIC APPARATUS

This represents a small field of employment for radio servicemen, but one which will likely grow steadily as greater use is made of electronic devices in these areas of activity.

The greater part of such work is usually done by engineers and technicians employed by firms that manufacture or distribute such equipment, or by commercial service organizations which employ engineers and technicians for this purpose. Radio shops and individual radio repairmen frequently service some types of industrial, commercial and scientific apparatus.

In large manufacturing establishments having a variety of electronic equipment, the routine servicing and repair work is sometimes done by plant electricians, who have had some training in electronics. In both large and small plants, major repair work is usually done by manufacturers', distributors' or commercial service engineers and technicians.

RADAR TECHNICIANS

In general, the duties of this comparatively small group of workers are similar to those of the radio serviceman but call for a more advanced knowledge of electronic principles (including "video") and of more intricate equipment. The radar technician may service other types of electronic equipment.

Radar men are to be found in the three military services, with a small number of concerns manufacturing and selling radar equipment, in government research establishments (National Research Council, Defence Research Board, etc.), in the merchant marine, and in air transportation.

RADIO SERVICEMEN IN OTHER FIELDS

Radio technicians are also employed by air lines to service ground and air radio equipment, by shipping companies, by police departments, radiotelegraph and radiotelephone companies, by government departments and research agencies, by large taxi companies using two-way radio, and by companies owning coin-operated phonographs.

QUALIFICATIONS

Because of the broad knowledge of fundamental principles required of the radio repairman today, it is important that he have as much high school training as possible, especially in mathematics and physics. Such training will facilitate the understanding of electronic principles.

Good physical condition, hand and finger dexterity, good hearing and eyesight (with or without glasses) are general requirements. Colour-blindness is a definite handicap. A fear of heights, or any limb disabilities that would interfere with climbing, are handicaps in installation work, such as the erection of receiver aerials. Mechanical and analytical ability, and a capacity for technical detail are other requirements. Where the repairman has to meet the public, as in community radio repair work,

a pleasant personality and the ability to sell one's services are important.

A number of physically handicapped workers have secured employment in the radio servicing field. The testing and repairing of radio sets at a bench can, for example, be done efficiently by certain handicapped workers who can finger, grasp and handle small tools and radio parts.

Servicemen are usually required to have their own sets of tools and portable testing equipment, but employers generally provide the more expensive and bulky electronic test equipment.

TRAINING

Training for this type of work may be obtained in a number of provinces at certain provincial technical schools and institutes, at private trade schools and sometimes on the job. Television, radar and the servicing of industrial, commercial and scientific electronic apparatus call for considerable further training beyond the basic level. Advanced and specific training in these fields is offered by a small number of public and private vocational schools, and by some manufacturers and distributors through on-the-job training programmes.

Technical school courses in radio and electronics usually last four years, and form a valuable preparation. Special courses are also available in other provincial schools; most of these have as their purpose the training of technicians for industry. A one-year course in radio for high school graduates in industrial courses is offered by the *Saint John Vocational School in New Brunswick.* The *Provincial Technical Institute in Moncton, N.B.,* also offers a course in radio servicing for industrial high school graduates. A four-year course in electronics, for those who have second year high school, is given at *special technical schools* in *Quebec, Three Rivers, Hull, Shawinigan Falls,* and *Rimouski.* The *Ryerson Institute of Technology, Toronto,* offers a course in Radio Technology lasting two years, and a course in Electronic Technology

lasting three years. The entrance requirement is secondary school graduation or equivalent. The two-year course is designed to train specialists in (1) Broadcast Equipment (Technical) — including FM and TV, (2) Electronic Laboratory Practice or (3) Radio, Television and Appliance Servicing. The three-year course prepares the students to become electronic technicians and provides a broad basic training which can be used in all branches of electronics, including television and radar. A radio course is offered by the *Manitoba Technical Institute, Winnipeg. The Provincial Institute of Technology and Art, Calgary,* gives a two-year course in radio and refrigeration servicing. The *Vancouver Vocational Institute* offers a course in radio.

A number of private trade schools provide basic courses, which last about nine months, in electronics to prepare men as radio servicemen and technicians; advanced courses are also offered.

Night-school and correspondence courses are other means of preparation. Training in the latter case, to be adequate, should be complemented by closely supervised laboratory work. Some trade schools offering home-study courses do make provision for laboratory practice.

In Alberta and British Columbia the trade of radio technician is designated for apprenticeship, the period of training being three years in both provinces.

In Prince Edward Island, a recent regulation requires radio repairmen in service establishments to be licensed after they have shown on examination that they are qualified to work on radios.

EMPLOYMENT OUTLOOK

Accurate figures on the number of radio repairmen, servicemen and mechanics in Canada are difficult to obtain. This group of workers is not shown separately in the 1941 census but is included, along with other occupations, in the more general group of electrical appliances repairmen. There were close to 3,400 electrical appliances repairmen gainfully occupied in 1941 in the fields of radio

servicing, manufacturing and broadcasting. Another 700 were on active service. An analysis of the distribution of the 3,400 repairmen by industry would indicate that fewer than 2,500 were radio servicemen or repairmen. If consideration be given to radio mechanics, who were classified elsewhere in the census, the total of 2,500 would represent a fairly good estimate of the number of radio repairmen, servicemen and mechanics gainfully occupied in Canada in 1941.

A high proportion of radio servicemen operate their own businesses. It is estimated that the proportion in 1941 was about 27 per cent.

Since considerably more of these workers are engaged in servicing than in manufacturing or radio broadcasting, some idea of the growth in numbers that has occurred since 1941 can be had from the increase in the number of licensed radio receivers in operation. From 1941 to 1949, there was an increase of over 40 per cent (from 1.45 million to 2.05 million sets). A comparison of the quantity of radio sets produced in 1941 with that produced in 1950 would indicate that there was also a considerable relative increase in the number of these workers in the field of radio manufacturing — over 98 per cent more receivers were sold in 1950 than in 1941. The large increase in the number of radio stations during this period also accounted for the employment of more radio repairmen and mechanics.

During the war years few new receivers were to be had. Consequently, at the end of the war there was much servicing to be done on the sets in use, which created a strong demand for radio servicemen. The demand was not strong enough, however, to permit the absorption of the many veterans and civilians who wished to enter this field, with the result that the radio servicing field became overcrowded, especially with partially qualified workers. During the past five years, however, the field has continued to expand, so that in all probability it is less overcrowded today than it was.

A demand for radio and radar technicians exists in the three services. There are also a number of openings for highly qualified technicians in Federal Government re-

search and other agencies. Some indication of the demand in radio manufacturing has already been given.

The considerable sale of television sets in the "fringe" areas in Ontario has resulted in a number of openings for qualified television servicemen.

Very few women are employed in radio servicing work.

Over the long run, opportunities in this field will, in all probability, continue to increase steadily. Natural growth in population, increased immigration, the trend towards two or more radio sets per home, the increasing use of automobile radios, and last, but not least, the influence of television, will all tend to stimulate the demand for radio repairmen and servicemen. For reasons already outlined, it will be some time before television will make for a strong general demand for servicemen in repair work. But when its full effects are felt there should be a greater need for servicing, because television sets are more complicated and require more frequent repair and adjustment. It is obvious that servicemen with a thorough training in television will have a greater advantage over those with only a knowledge of AM and FM equipment.

The increasing use of two-way FM radio communication by taxi companies, trucking companies, and others, will also make for a small number of employment opportunities for radio repairmen and servicemen.

The greater use of electronic devices in industry will probably not result in many openings for electronic technicians as such in the industrial field. Even though industrial concerns will be doing more and more of their own servicing, this will most likely be done in large part by plant electricians. Electricians are being encouraged to prepare themselves for taking over the servicing of electronic devices. There may be more openings, however, with manufacturers and distributors of electronic equipment who install and service their own equipment.

The servicing of electronic equipment in the commercial field may provide a steadily expanding field for technicians, especially for those employed by commer-

cial and radio repair organizations. This field, however, will provide opportunity only for highly qualified technicians.

It can be expected that radar will come into much greater use in civilian aviation and shipping, which will make for more openings for radar technicians, although the number will likely not be great. It has already been said that a strong demand for radar men exists in the military services, and this will probably become greater.

In summing up, the field of radio servicing, repair and maintenance is an expanding one, but the number of openings that can be expected from it should not be overestimated. Because the field is attractive to many, there is always the danger of too many entrants and consequent overcrowding. It offers good opportunities for the thoroughly skilled man, but a precarious living for the less skilled.

VII. EARNINGS

RADIO OPERATORS (Certificated)

Radio officers on ships and aircraft, and ground radio operators in civil aviation are among the highest paid workers in the field of electronics. A typical basic wage for radio officers on Canadian ships covered by union agreements is about $290. per month. Overtime pay is also stipulated. On vessels carrying fifty tons or over of explosives, an additional allowance of $15 per month is paid.

Flight radio officers on Trans-Canada Air Lines aircraft receive the following monthly rates of pay:

Flight Probation Period (max. 3 months)	$315.00
1st six months as Flight Radio Officer	340.00
2nd six months as Flight Radio Officer	385.00
3rd six months as Flight Radio Officer	445.00

Ground radio operators with Trans-Canada Air Lines, following a period of training, start at $195. a month and

receive regular increases until a maximum of $268. per month is reached. All operators are required to serve a probationary period of six months.

The rate of pay for ground radio operators with Canadian Pacific Air Lines Ltd. varies according to the type of airport, ranging from $165. a month on small stations to $230. a month on large stations. On a good many stations, the work of the operator is combined with that of agent or despatcher. Operator-agents receive anywhere from $185. to $200. per month; operator-despatchers, $230. to $250. per month.

The schedule of pay on Department of Transport stations is as follows:

Radio Operator, Grade I	**$2,436 — 3,240 per year**
Radio Operator, Grade II	**$3,036 — 3,444 " "**

Extra allowances are paid and free board and lodging provided to operators on isolated stations. Proficiency examinations have to be passed for promotion.

RADIO BROADCASTING OPERATORS AND TECHNICIANS

The following table shows the average weekly earnings of technical personnel in *private* radio broadcasting stations, by occupation, as of October 1949. Although the averages are for Canada as a whole, they give a fairly representative picture. The main exception to this is the occupation of Chief Engineer, which has a greater variation as between provinces.

The current average weekly earnings may be higher than the rates quoted below because of wage increases since October 1949.

AVERAGE WEEKLY EARNINGS OF TECHNICAL PERSONNEL ON PRIVATE BROADCASTING STATIONS, FOR CANADA, BY OCCUPATION, OCTOBER 1949

Control Operators	**$34.64**
Technicians	**43.04**
Chief Engineers[1]	**49.94**
Engineers[1]	**42.77**
Transmitter Operators	**37.86**

[1] Most of these are not professional engineers.

Many private stations in medium-size and metropolitan urban areas have group medical and pension plans. In the four western provinces many private stations have a cost-of-living bonus scheme, plus some form of profit-sharing for all employees with a year's service or more.

As the *CBC* is now carrying out a job and wage analysis covering all positions on its establishment, salary rates are not available. For some years, however, the CBC has endeavoured to establish salary scales for the various types of employment at market rates in comparable employment. The welfare plans provided by the CBC are quite extensive and include group pension plan and group insurance plan — both on a joint contributory basis—, group hospital and medical plans where these plans are available in the province in which employed, three weeks' vacation leave with pay each year, cumulative sick leave, and special leave to cover certain domestic contingencies.

RADIO MANUFACTURING

The table on Page 50 shows the average wage rates for certain occupations in the manufacture of radios and parts, as of October 1950. The average standard hours worked per week then were approximately 43. Earnings today may be higher than shown because of increased rates of pay. Readers are advised to consult local employers, union representatives or newspaper advertisements as to the present situation.

RADIO SERVICEMEN AND TECHNICIANS

There is a lack of uniformity in wage rates in the home radio servicing field. In some provinces minimum rates are set. In some cases a straight hourly rate is paid, in others an incentive wage basis is used, which may be 50 or 60 per cent of the repair cost. Automobile radio repairmen employed by garages usually work at the same rates as automobile mechanics.

Radio technicians in the Federal Government service are relatively well paid. A Radio Technician, Grade I, receives \$2,904 — \$3,240 per annum; a Radio Technician Grade 5, \$3,888 — \$4,524 per annum.

AVERAGE WAGE RATES FOR SELECTED OCCUPATIONS IN RADIOS AND RADIO PARTS MANUFACTURING, OCTOBER 1950

Occupation and Locality	Average Wage Rate per Hour	Range of Rates Per Hour
	\$	\$
ASSEMBLER, MALE		
Canada	.93	....
Quebec (Montreal only)	.95	.79—1.24
Ontario	.93	.80—1.06
Toronto	.94	.85—1.06
ASSEMBLER, FEMALE		
Canada	.81	....
Quebec (Montreal only)	.93	.77—1.12
Ontario	.78	.60— .97
Toronto	.83	.69— .97
INSPECTOR, MALE		
Canada	1.05	....
Quebec (Montreal only)	1.14	.96—1.32
Ontario	.94	.75—1.06
Toronto	.98	.75—1.09
INSPECTOR, FEMALE		
Canada	.84	....
Quebec (Montreal only)	1.01	.97—1.02
Ontario	.80	.60— .94
Toronto	.86	.75— .98
TESTER		
Canada	1.08	....
Quebec (Montreal only)	1.14	.96—1.37
Ontario	1.00	.80—1.15
Toronto	.99	.75—1.25

VIII. ORGANIZATIONS

Labour

Radio officers on ships and aircraft and ground radio operators in civil aviation are all highly organized. The main labour organizations in this field are:

Canadian Communications Association (C.C.L.)

Commercial Telegraphers' Union (T.L.C.)

The Order of Railroad Telegraphers (A.F.L.)

Technical personnel in radio broadcasting are not well organized yet, but the trend towards unionization in this field is growing.

The main unions in the manufacturing field are the United Electrical, Radio and Machine Workers of America (Independent) and the International Brotherhood of Electrical Workers (T.L.C.). There are also a number of employees' associations.

Not much progress has been made in the unionization of radio servicemen.

Other

Canadian Association of Broadcasters

Canadian Radio Technical Planning Board

Radio Television Manufacturers' Association of Canada

Manitoba Radio Service Association

Canadian Association of Radio and Appliance Dealers

Ontario Association of Radio and Appliance Dealers

Engineering Institute of Canada

American Institute of Electrical Engineers (Branches in Montreal, Toronto and Vancouver)

Institute of Radio Engineers (Canadian Council) (Radio technicians eligible for associate membership)

Radio Electronic Technicians' Association (Ontario)

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LOCAL INFORMATION

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The monographs listed below, accompanied by pamphlets, except in the case of numbers 13 and 20-35, have been published to date. Those from 20-35 have been published collectively.

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(9) *Printing Trades*

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(12)

(13)

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(22) "Biologist"

(23) "Chemist"

(24) "Geologist"

(25) "Physicist"

(26) "Aeronautical Engineer"

(27) "Ceramic Engineer"

(28) "Chemical Engineer"

(29) "Civil Engineer"

(30) "Electrical Engineer"

(31) "Forest Engineer and Forest Scientists"

(32) "Mechanical Engineer"

(33) "Metallurgical Engineer"

(34) "Mining Engineer"

(35) "Petroleum Engineer"

DEPARTMENT OF LABOUR

Economics and Research Branch

OTTAWA, 1951

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Canadian Occupations

Monograph 16

ELECTRICAL AND ELECTRONIC OCCUPATIONS

Revised 1962

Prepared
by the
Economics and Research Branch
of the
Department of Labour, Canada

HON. MICHAEL STARR
MINISTER

GEORGE V. HAYTHORNE
DEPUTY MINISTER

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FOREWORD

During recent years there has been a steadily increasing demand for Canadian occupational information. The demand comes from young people faced with the need of choosing an occupation and preparing for it; from parents, teachers and vocational guidance counsellors; from workers wishing to change their occupations; from employment service officers; from personnel directors and union officials; from prospective immigrants to Canada and from other quarters.

THE CANADIAN OCCUPATIONS series of monographs is designed to help meet this demand. Each booklet describes, among other things, the nature of the occupation or groups of occupations, entrance and training requirements, working conditions and employment outlook.

The series has been prepared with the generous assistance of representatives of management, trade unions and professional associations. The co-operation of the Unemployment Insurance Commission, the Vocational Training Branch of the Department of Labour, and the Dominion Bureau of Statistics is gratefully acknowledged.

Occupational information tends to become dated as a result of changes in economic conditions, in industrial technology and in wage and salary structure. Revision of outdated publications is a regular feature of the series.

This booklet was prepared and written for the Manpower Resources Division by Alvin E. Styles and William Coe under the direction of William Allison, Head of the Occupational Analysis Section. The help and co-operation of many organizations and individuals working in the electrical fields are gratefully acknowledged.

J. P. FRANCIS,
Director,
Economics and Research Branch,
Department of Labour.

April 1962

CONTENTS

PAGE

HISTORY AND IMPORTANCE 9

BROAD FIELDS OF WORK 11

TYPES OF WORKERS 11

ELECTRICAL WORKERS 13

ELECTRICIANS 13
- Nature of Work 13
- Types of Electricians 14
- Construction Electricians 14
  - Nature of Work 14
  - Field of Work 15
  - Preparation and Training 16
    - Apprenticeship Training 16
    - Apprenticeship in Quebec 18
- Maintenance Electricians 19
  - Nature of Work 19
  - Field of Work 20
  - Preparation and Training 20
    - Apprenticeship Training 21
  - Personal Qualities Needed 22
  - Advancement 22
  - Working Conditions 23
  - Organizations 23
  - Employment Outlook 23

SPECIAL FIELDS OF ELECTRICAL WORK 24
  - Electricians in Industry 24
  - Electrical Technicians 26

ELECTRONIC WORKERS 28

RADIO AND TELEVISION SERVICEMEN 29
Field of Work 29
Nature of Work 30
Personal Qualities Needed 31
Preparation and Training 31
Advancement 32
Working Conditions 32
Employment Outlook 33

ELECTRONIC TECHNICIANS 33

POWER GENERATION AND DISTRIBUTION WORKERS 38
Field of Work 40
Nature of Work 41
Generation—Hydroelectric Power 41
Generation—Thermalelectric Power 44
Transmission and Distribution 45
Preparation and Training 48
Personal Qualities Needed 49
Advancement 49
Working Conditions 50
Organizations 51
Employment Outlook 51

TELECOMMUNICATIONS WORKERS 53

TELEPHONES 54
Field of Work 55
Nature of Work 56
Central Office Group 56
Linemen Group 58
Station and PBX Group 58
Personal Qualities Needed 60
Preparation and Training 61
Advancement 62
Working Conditions 63
Organizations 63
Employment Outlook 63

TELEGRAPHS ... 65
Field of Work ... 66
Nature of Work ... 68
Personal Qualities Needed ... 71
Preparation and Training ... 71
Advancement ... 72
Working Conditions ... 72
Organizations ... 72
Employment Outlook ... 72

RADIO OPERATORS ... 73
Field of Work ... 74
Nature of Work ... 75
Personal Qualities Needed ... 76
Preparation and Training ... 77
Advancement ... 78
Working Conditions ... 78
Organizations ... 79
Employment Outlook ... 79

BROADCASTING—SOUND AND TELEVISION ... 80
Field of Work ... 81
Nature of Work ... 82
Sound Broadcasting—Operation ... 83
Sound Broadcasting—Maintenance and Development ... 84
Television Broadcasting ... 85
Personal Qualities Needed ... 89
Preparation and Training ... 89
Advancement ... 90
Working Conditions ... 90
Organizations ... 91
Employment Outlook ... 91

SEEKING EMPLOYMENT ... 91

EARNINGS ... 92
Table 1—Electricians ... 93
Table 2—Power Generation and Distribution Workers ... 94
Table 3—Telecommunications ... 95

ELECTRICAL AND ELECTRONIC OCCUPATIONS

HISTORY AND IMPORTANCE

Many men have contributed to the sum of knowledge of electricity and the history of these contributions may be considered as a four-part story.

The first part had its origin about 2,500 years ago when Thales, a Greek philosopher, rubbed a piece of amber to discover static electricity. And someone, probably in China, found that certain dark and heavy stones had the power to attract, and even lift, pieces of iron. This, the power of magnetism, was to find practical use down through the centuries in the mariner's compass.

Centuries passed before the second part of the story unfolded. First of the moderns to set the stage was William Gilbert in the 16th century. He, probing the mysteries of the lodestone, discovered in it most of the principles we call magnetism. Repeating the experiments of Thales, he drew on the old Greek word for amber, *elektron*, to coin the now familiar word, *electricity*; his work, "De Magneto", won for him universal recognition as the father of electrical science.

Another century passed before Stephen Gray called attention to the differences between conductors and non-conductors; and it was during this period that friction machines capable of producing small amounts of electricity came into being.

The pace quickened in 1745 with the invention of the Leydon Jar. Discovery of this device, in which charges of static electricity could be built up and stored, provided the basic principles for some of the most important advances in electrical science.

Interest in electricity was by this time becoming widespread in America as well as in Europe. Benjamin Franklin's famed kite investigations provided the link that joined the Old World and the New in a common search for further knowledge.

In 1786, Luigi Galvani discovered the electrical potential between dissimilar metals—galvanic action. Another Italian scientist, Volta, applied these findings to construct a wet-cell battery—the first really new way to produce electricity since Thales rubbed amber in 600 B.C.

In Denmark, Hans Christian Oerstad, experimenting with Volta's batteries, found that electricity in motion produced magnetism.

Such was the state of electricity when, in 1831, Michael Faraday and Joseph Henry, working independently, discovered that electricity is induced when a piece of metal is moved in a field of influence of a magnet—this led to the discovery of the dynamo. With this discovery, mechanical energy could now be converted into electrical energy efficiently, cheaply and in quantity. Faraday thus made it possible to put into use operations which, up to this time, had merely been laboratory experiments.

The third part of this story is more recent history. Thomas Alva Edison in 1879, building the first incandescent lamp; the harnessing of water to drive the dynamo he, Thomson and Brush, and a score of other experimenters developed; invention by Stanley of the transformer by which generated voltages could be stepped up or down to bring power to homes and industry over great distance from the source; Sprague and his motors to operate domestic and industrial services and to revolutionize modern living; Steinmetz and his mathematical formulae which turned a temperamental art into an exact science.

And so, through the contributions of these and thousands of other inventors and scientists and their unknown assistants, electricity came of age.

The fourth part of this story, commenced some forty years ago, is still being written. This era has seen the development of radio, of television and of electronics; the automation and computers of industry; the electron miscroscope and the electronic cardioscope to extend the boundaries of science and medicine; the cyclotron and betatron of the atomic energy fields; and the guidance systems for air and space travel.

Much remains to be done to complete this story. But the maintenance of present standards and the future development will be the tasks of teams of highly educated and technically trained personnel—the scientists, technicians, tradesmen and skilled workers. The era of the single inventor working in solitude has virtually ended.

BROAD FIELDS OF WORK

Electrical and electronic occupations are found in every community—from the smallest hamlet to the largest city.

As in all large industries, the electrical and electronic fields offer careers in many types of work—in administration, accounts, sales, service and clerical, to mention a few. Reference can be made for details of these non-technical occupations to other monographs in the CANADIAN OCCUPATION series of booklets (listed on the inside cover). This booklet covers technically trained workers, below university level, in the following broad fields of work:-

Electrical Construction and Maintenance—

in residential, commercial and industrial buildings, and in industry.

Electronics—

in industry, offices and communications and the servicing of equipment where the electron flow is controlled by vacuum tubes, gas tubes, solid-state conductors (transistors) and similar devices.

Electrical Power—

in generation, transmission and distribution, and the maintenance of these services.

Telecommunications—

in the telephone, telegraph, radio and television industries.

TYPES OF WORKERS

Electrical workers may be divided into four main types—engineers, technicians, tradesmen and related workers.

Professional engineers (P. Eng.) are those who have qualified for registration with a provincial engineering association. The qualification required is either a bachelor degree in engineering from a university or college or the passing of examinations approved by the provincial association, together with two years of practical experience.

In the broad fields of work previously mentioned, their duties include administration, planning, design and development, usually as heads of sections. Since this booklet has not been designed to

cover those at professional or university level, only brief details are given to indicate their role in relation to other workers. They are covered in detail in the CAREERS IN ENGINEERING monograph in this series.

Stationary engineers, mentioned in this booklet in connection with thermalelectric power, should not be confused with the professional engineers; they are qualified by provincial certification to operate stationary power plants.

Other supervisory workers, loosely called "engineers" will be found in the electrical industry but this is a classification given by a particular company mainly for administrative and salary purposes.

Technician is another title which is loosely used. It is applied to a variety of workers at many differing levels of skill. They range from those who as members of research teams develop new ideas and systems, through the group engaged in repair, installation and testing, to those with a company classification of "technician" only. Their training depends on their duties and field of work. In the higher group, they are graduates of post high-school, technical or vocational institutes; others are trained in a series of progressive steps on the job, either with or without benefit of classroom studies.

Tradesmen are considered as those who have completed an apprenticeship, either formal or informal, or who have received equivalent training. They lay out, install, operate and maintain a product or a service and require, in addition to theoretical tuition, considerable skill in the use and handling of the tools and equipment of the trade. It should also be noted that, depending on the industry in which they are engaged, they may be known by alternative job titles. For example, where precise skills are used, as in the telephone industry, they are called craftsmen; those who have completed a formal apprenticeship—construction electricians—may be called journeymen.

Other workers, after a series of on-the-job training steps, perform specialized functions in one or several aspects of electrical work; for instance, the electrical operators in power generation or production workers—wiremen and winders—in the electrical manufacturing industries.

ELECTRICAL WORKERS

Electricity, one of mankind's most valuable servants, has gone through many stages of development and its uses are ever increasing.

Today, electrical services reach into almost every phase of our daily lives—in homes, offices and workshops—performing the tasks of lighting, heating and air-conditioning, providing power to turn the wheels of industry and making possible the voice of the telegraph and radio and the eyes of television.

However, to put this valuable servant to work requires skilled craftsmen who have had the lengthy training and experience to qualify them in its use—these are known as "electricians".

Included in this booklet are the electricians in construction, maintenance, power generation, stage and studio, marine, railway and aircraft trades. Not included are mechanic/electricians in the automotive trades, refrigerator mechanics, appliance and shop repairmen (although radio and television repairmen are covered in this booklet) and the bench and production workers in the electrical manufacturing industries.

ELECTRICIANS

Nature of Work

The basic work of all electricians includes the following.- Layout, installation, maintenance and testing of electrical circuits, fixtures and apparatus, signal systems and control equipment used in the lighting, heating, air-conditioning and other systems in residences, commercial and manufacturing establishments, schools, hospitals and other structures. An electrician is required to use and maintain hand and power tools, portable equipment and testing and measuring instruments. A thorough knowledge of the Canadian Electrical Code is required since it must be adhered to in certain regions and types of work. In addition, he is required to know, and his work must comply with local, provincial or municipal regulations.

Types of Electricians

Electricians are classified according to the kind of work they do or the industry in which they are engaged. Since training, entry and other important aspects differ according to this classification, the occupational titles are explained in the following paragraphs.

Construction electricians, as the name implies, undertake new electrical installations on building projects and alterations to, or extensions of, existing installations.

Maintenance electricians repair, service and maintain electrically operated machinery or other equipment used in a particular industry or industrial process; this, for example, may be an electrically-driven sewing machine in the textile trade or a rolling mill in the steel industry. They also service and maintain the electrical power supplies to the machinery.

Other electricians install or maintain electrical equipment in a variety of manufactured products; these tradesmen are referred to in this booklet by the name of the industry in which they work i.e., "ship electrician" or "aircraft electrician".

Construction Electricians

Nature of Work

Duties of the construction electrician depend on the type of building project but are usually in four main steps. First someone has to work out how the job is to be done and this is known as "lay-out". Then wiring, cables and conduits are run between the supply points and the points where the current is to be used. Next, switch boxes, pull boxes and other concealed equipment are installed before the walls are plastered and the floors laid. At a later stage in the building program, various fittings are installed such as service panels, transformers, meters, lights, motors and power equipment and the specialised gear needed in a particular industry. Finally, the whole installation must be tested before the main supply can be safely connected. There are two important tests to be carried out; one is to ensure that the installation is connected efficiently and correctly and the other, that the installation is safely insulated. For these tests, measuring and resistance testing instruments are used.

:onstruction electrician running
onduit and making connections to
control cabinet induction motor
est area.

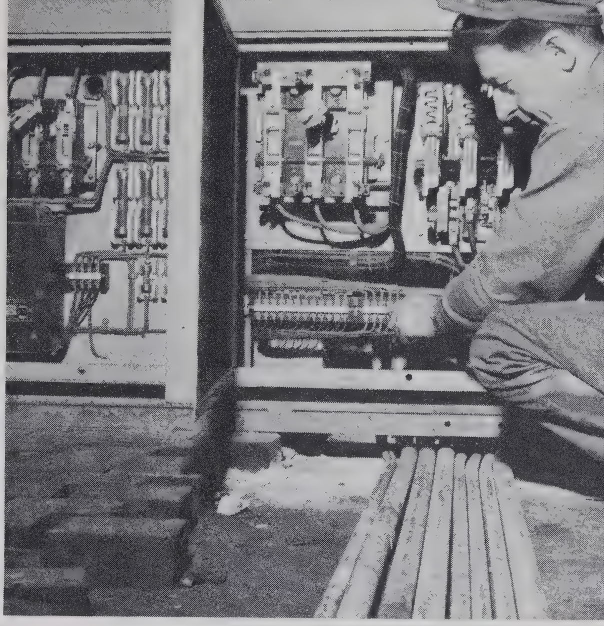


Photo: Canadian General Electric Co. Ltd.

The degree of responsibility varies with the extent of the project. On the larger projects, installations are made according to drawings and specifications prepared by electrical draftsmen; on the smaller jobs, the electrician is responsible for the complete installation including planning, lay-out, testing and conformity to regulations.

Field of Work

Construction electricians are employed in large numbers by electrical firms who either contract directly to building-site developers or obtain work on a sub-contract basis from building contractors; others are employed on the payroll of building contractors or larger companies who undertake their own electrical work. A percentage are self-employed and obtain repair, alteration and installation work from the home owner and small contractor.

From this it will be realized that there is no end to the variety of construction projects. There may be a contract for the lighting, heating and power supplies of a new factory providing work for scores of electricians lasting many months; or a simple housewiring job taking a few days for one man and his apprentice.

Preparation and Training

In most provinces, the Apprenticeship Branches of the Provincial Departments of Labour have drawn up schemes for apprentice electricians in the construction industry. Age limits for new apprentices vary from a minimum of 16 years (15 years in British Columbia) to a maximum of 21 years although certain provinces give special consideration to those over these ages.

Minimum education standards required for entry vary from province to province and range from grade 8 to grade 11.

Graduation from a technical or a vocational school with good marks in mathematics, drawing and physics is desirable; graduation from a vocational high school electrical course will improve chances of acceptance and the apprenticeship period may be reduced.

Many provinces have pre-employment training classes (from six to eleven months, depending on the province) for prospective apprentices and, on completion of this course, a reduction of the apprenticeship period is allowed.

Apprenticeship Training

Construction electricians serve an apprenticeship period of four years (in New Brunswick five). During this period, an apprentice works for an employer and learns the practical side of the job by working with a skilled worker and is also required to attend school where he is taught the theory of his trade.

An apprentice enters into a written agreement—called an "indenture"—with his employer which states certain terms such as length of apprenticeship, the major process in which the apprentice will be taught, the number of hours schooling, pay scales (these vary from province to province and even from one district to another in the same province) and general working conditions.

In several provinces the indenturing agency (authorized to sign apprenticeship agreements), in addition to the individual employer, may be a trade union, an employers' organization or an apprenticeship committee.

A three to six month probationary period is usually required. All apprenticeship agreements allow for cancellation of the indenture. Cancellation of the indenture may be the decision of the apprentice or of the employer who, by trade tests or personal observation may decide, subject to agreement with the apprenticeship committee, that the apprenticeship be terminated.

In addition to on-the-job training, apprentices are required to attend trade courses at technical or vocational schools operated by the province or municipality. These courses cover the theory and practices of the trade together with general educational subjects. Apprentices attending full-time classes are paid living and travelling allowances.

Following is a summary of the provincial requirements for full-time classroom instruction during apprenticeship although it must be appreciated that these requirements are subject to change.

Newfoundland	3 to 12 weeks each year of apprenticeship.
Nova Scotia	6 to 10 weeks each year.
New Brunswick	9 weeks each year (or the equivalent in part-time or evening classes).
Quebec	Refer to paragraphs dealing with apprenticeship in Quebec.
Ontario	10 weeks in each of first two years.
Manitoba	8 weeks (Junior Course), 6 weeks (Intermediate Course) and 4 weeks (Senior Course).
Saskatchewan	10 weeks (Junior Course), 8 weeks (Intermediate Course) and 8 weeks (Senior Course).
Alberta	8 weeks each year of apprenticeship (or as laid down in the Apprenticeship Agreement).
British Columbia	4 weeks each year.

Where it is difficult in certain provinces for apprentices to attend full-time courses, the equivalent can be obtained through evening classes. Correspondence courses are also available for those unable to attend vocational schools and they are often used by ambitious apprentices to supplement classroom study.

On completion of apprenticeship and trade testing, the apprentice is awarded a journeyman's certificate. Interprovincial standards for the examination of graduating apprentices have been established. Those who pass the interprovincial examinations are awarded a certificate bearing an Interprovincial Seal attesting to the standards of competence and recognized in most provinces as a certificate of competence without further trade tests.

Apprenticeship in Quebec

In Quebec, apprenticeship programs are conducted by Apprenticeship Commissions, each of which controls apprenticeship in its own area. Apprentices are not ordinarily indentured to an employer, but they are required to register with the Apprenticeship Commission in their own area.

The beginner, if he chooses, may go directly into the trade and serve a four-year training period. A more desirable way, and one that is encouraged by apprenticeship officials and employers, is for the prospective apprentice to first prepare himself in one of the pre-employment classes. These classes, provided at special schools conducted by Apprenticeship Commissions in Chicoutimi, Hull, Joliette, Montreal, Quebec, St. Jerôme and Sherbrooke, are of six to ten months' duration and the time spent is applied towards a reduction of the apprenticeship period. Graduates of pre-employment classes are preferred by employers and may start at a higher rate than those who do not have the benefits of previous training.

While working on the job, apprentices are encouraged to take evening instruction in classes operated by the Apprenticeship Commissions or in regular provincial technical or vocational schools. Attendance at these classes may also shorten the apprenticeship period.

At the end of training, all apprentices in Quebec are trade tested and, if successful, are awarded a "Competency Card" denoting journeyman status.

Maintenance Electricians

Nature of Work

The main job of the *maintenance electrician* is to keep the equipment and power supplies for which he is responsible in good order and, if a fault develops, to find out quickly what is wrong and put it right. A breakdown caused by an electrical fault could cost a company many thousands of dollars in loss of production, a heating system failure during inclement weather could have serious consequences.

Therefore, to prevent an actual breakdown, the maintenance electrician tests, inspects, cleans and adjusts the installations in his charge at regular intervals and replaces any piece of equipment which seems defective. Often he works to a preventive maintenance schedule and keeps records showing the condition of the installation.

Maintenance electrician trouble shooting on industrial equipment.

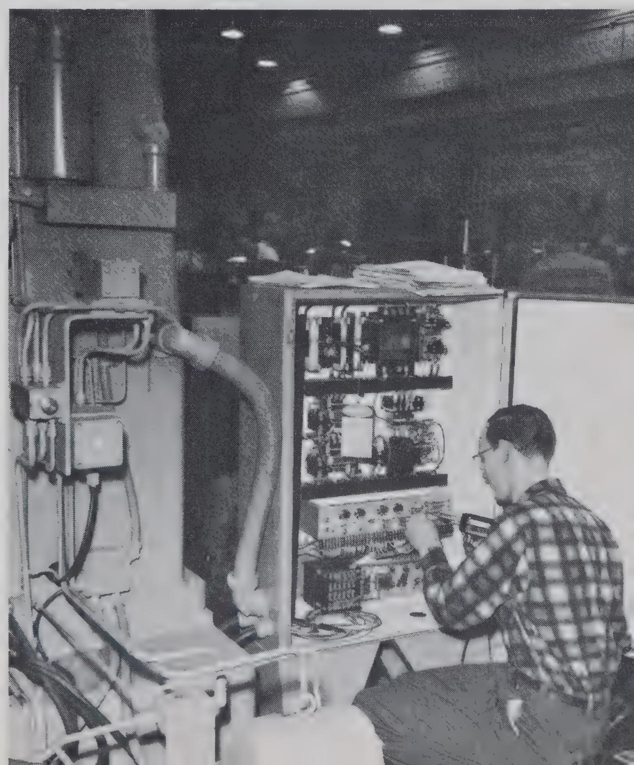


Photo:
Canadian General
Electric Co. Ltd.

When a fault develops, he must solve the problem and his tasks may range from changing a simple fuse to fault-finding or major repair on machines, motors, generators, controllers and other equipment. In the latter case, he uses test meters and apparatus or may be required to trace the fault step by step using circuit diagrams which are often quite complicated.

Field of Work

Almost every industrial, business and commercial establishment employs maintenance electricians and they will be found in such establishments as steel mills, government buildings, airports, pulp and paper mills, furniture factories, department stores, schools and hospitals.

Most electrical contractors and some power supply companies have repair departments and workshops to meet the needs of their customers—householders, business establishments and industrial firms—when faults develop in their electrical installations. In some districts, contractors undertake this kind of work as their main activity. Where this arrangement is in force, maintenance electricians work "outside", that is, they are called in when faults develop and make regular visits to customers to keep their equipment in good order.

Preparation and Training

Maintenance electricians are trained by formal apprenticeship schemes or less formally by on-the-job training methods set up by the individual employer. Apprenticeship methods have certain advantages—they provide broader knowledge, create all-round tradesmen and allow movement from one district or province to another without additional training.

Entry and also training depend, to a large extent, on the employer although a number of employers have plans registered with the provinces. All employers have a screening process, either by interview, written tests or a combination of both for applicants.

In general, entry requirements of age and education are similar to those for the construction electricians. Employers, particularly those with planned methods of promotion, give preference to graduates from vocational or technical high schools.

Apprenticeship Training

Except for the following differences, apprenticeship training for maintenance electricians is similar to that of the construction electricians previously explained. Apprenticeship is usually for four years—some companies and the province of British Columbia require five years.

Again the apprentice enters into some form of agreement with the employer and administered either by a plant committee (management, labour and an educational representative) or a company committee (personnel management and shop supervisors). Industry, and Labour as represented by the trade unions, are co-operating on advisory committees towards better combination of practical training and theoretical studies.

The major process in which an apprentice will be trained depends on the kind of work done by the company. Large enterprises such as chemical plants, paper mills, local and provincial agencies, usually have their own maintenance and repair sections. Their apprentices get experience on different types of work and equipment and later they may specialize on that which they can do best.

Training is obtained by working as an assistant to a qualified tradesman; tuition in theory and techniques of the trade may be given in schools operated by the company. Periods of full-time attendance at local or provincial vocational schools may be expected.

When the apprenticeship is completed, most companies award a certificate stating the training and school subjects taken by the apprentice. Should the company be registered with the province, a provincial certificate is also awarded.

In some provinces it is compulsory for electricians to obtain a certificate of proficiency by examination; some local authorities also require that electricians pass an examination before the trade can be practised in their area.

Personal Qualities Needed

Among the most important qualities needed to be successful as an electrician are:-

A keen sense of *responsibility*; electricity is safe when properly used, but slipshod or careless work could easily cause a fire or fatal accident.

Self-reliance and *confidence*—an electrician often works alone without supervision and must make many decisions.

Methodical approach and *common sense* are important—there are many ways of doing most installations.

Good *colour vision* is essential (electrical cables and equipment are identified by colour coding) as is the ability to work at heights or in confined spaces.

Cleanliness and *neatness*, both in work habits and in person are expected since the work takes him into homes and offices.

There is no need to be a great scholar; a sound knowledge of mathematics and science, the ability to write an account of his work, to understand specifications and drawings together with sufficient aptitude to benefit from vocational school tuition are sufficient.

For the maintenance electrician most of the foregoing holds true. In addition, he must be painstaking and methodical so that the equipment in his charge works smoothly with the minimum of breakdown; should a breakdown occur, he must be able to think and act quickly and work under pressure.

Advancement

While the electrician, like other tradesmen, can find sufficient satisfaction in the interest of his job, ever increasing use of electricity offers good prospects of promotion to the competent worker who has mastered the principles of his trade and has the right personal qualities.

The path of advancement in the construction trades leads to foreman or supervisor or to inspection work and may lead to self employment as an electrical contractor.

For the maintenance electrician, openings are often available, particularly to those who have taken extra tuition—in say elec-

tronics or their company products—leading to a drafting board, sales and service, production planning and inspection as well as supervisory positions in the electrical sections of their own companies; again the path to self-employment is open.

Working Conditions

In most of the industries mentioned in this booklet, working conditions are safeguarded by local and provincial regulations.

Most electrical work is undertaken indoors. On building projects, construction electricians are exposed to cold and wet weather and may work in confined spaces, from tall ladders and from scaffolding.

The work of maintenance electricians depend on the type of company for which they work; they may be employed by a department store, in a heavy industrial plant or down a mine and will work under the conditions prevailing in that particular company.

In general, a five-day, 40-hour week is worked although maintenance electricians may work on a shift basis depending on the hours prevailing in their company.

Construction electricians may work considerable overtime in summer with some slackening off or unemployment during the winter in common with all building trade workers; however, they are less affected by the weather than other building trade workers. The maintenance electrician is less affected by seasonal conditions; he is required to work on replacement of equipment during the weekends and at other times outside normal company hours to avoid interruption of production.

Organizations

Construction electricians and many of those in maintenance are covered by the International Brotherhood of Electrical Workers. Other maintenance electricians, and those in industry often belong to an industrial union in their particular industry.

Employment Outlook

What the future holds in the way of employment opportunities depends on several factors including the building program, the ex-

port trade and purchasing power at home. These factors can change fairly rapidly and, therefore, long range predictions cannot be given with any degree of accuracy. All that can be said is that the outlook for the next few years is reasonably favourable.

For the construction electrician, since no marked increase in building activity over the next few years has been forecast, it is expected that the majority of openings will result from the need to replace those who retire or transfer to other fields of work.

For the maintenance and industrial electricians, changing conditions and new developments, including the trend towards the increased use of electrical (and electronic) devices in the industrial, commercial and residential fields are expected to result in additional job openings.

SPECIAL FIELDS OF ELECTRICAL WORK

The following paragraphs give brief details of fields of work in which the entrant receives a more specialized type of training to meet the requirements of a particular industry.

Electricians in Industry

Ship electricians are trained by apprenticeship methods. The apprentice works aboard ship and in the shipyards as an assistant to a skilled tradesman and follows a course of classroom study often provided by the company. Further training in the theory and techniques of the trade are learned by attendance, either full-time or part-time, at vocational or technical institutes.

Electrical installations aboard ship are similar to those of a small town depending on its own resources for lighting, heating, communications and power. There is a generating plant with control gear, heating and refrigerating systems, and perhaps even a theatre or movie stage.

Aircraft electricians are in two groups. One group is in the aircraft manufacturing industry and the other maintains passenger and freight aircraft of the publicly and privately owned airlines.

Modern aircraft contain several miles of electrical wiring, many electrically operated instruments, power supplies including generators, alternators, and transformers and electrically controlled or

operated flying controls; heating and landing gear systems; this is the field of work for the aircraft electrician.

Conscientious work, with close attention to detail, is called for as well as the ability to work methodically on complicated circuits. New entrants serve an apprenticeship with the company and their training will include electronic studies as well as electricity.

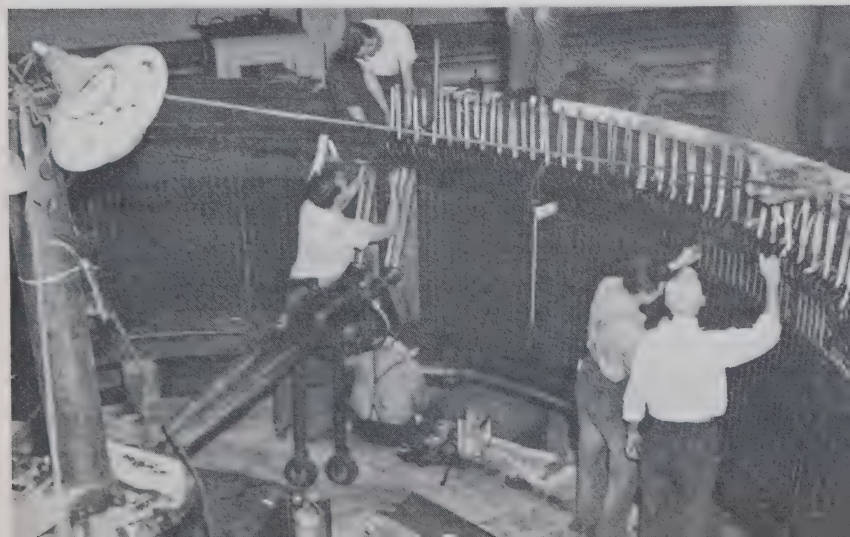
Mine electricians are employed both above and below ground. They deal with a variety of installations as well as the testing and maintenance of existing equipment.

Railway electricians undertake work at stations, power houses and other buildings and on rolling stock. The railways have extensive signalling systems and telegraph services for which they train their own construction and maintenance electricians.

Power station electricians repair and maintain equipment and installations in power-generating stations and substations.

Stage or *studio electricians* are responsible for the setting-up, maintenance and operation of either stage, theatre, motion picture or television studio electrical services.

Power Station electricians rewind an 18,500 KVA generator.
Photo: Shawinigan Water & Power Co.



Electrical Technicians

With the rapid advances in the field of electrical science bringing about increased complexity in the field, a group of workers gradually developed and were to become known as "technicians". The term "technician" has a wide variety of interpretations in industry, government and educational circles. Because technician occupations are still evolving, any definition of the boundaries of the group or of job duties will alter from time to time. For the purposes of this booklet they are considered as specialists in one or several aspects of electrical technology and concerned with the practical application of established theories rather than the discovery of these theories.

They are to be found in every phase of industry. Some contribute their knowledge to the supervision, installation, maintenance and manufacturing of electrical or electrically operated equipment; others prefer the load planning and distribution departments of public utility companies; still others are in the communications field in supervision, planning and the operation of telephone systems and sound or television broadcasting.

Training methods in the past have tended to vary considerably and took the form of on-the-job training together with part-time studies either in a company-operated school or by part-time, evening or correspondence tuition. With technological advancement, these methods became inadequate to meet the needs of industry. Institutes of technology were therefore developed and a gradually increasing number of technical positions were filled by graduates of these institutes.

Today, there is a marked emphasis on technological training—new technical institutes are being built and the existing ones extended in all provinces—and it is expected that graduation from an institute of technology will become the regular method of entry.

As will be realized, these are positions requiring a higher scholastic background than is provided in high school. This education, together with specialized training in the technology, is obtained after high school graduation by full-time attendance at a technical institute or by part-time attendance at evening extension courses offering technical training at recognized levels.

A student at an institute will study the laws of physics, including mechanics, heat, light and sound; mathematics including advanced algebra, geometry (analytical and descriptive) and trigonometry with perhaps some calculus; electrical principles, circuits, measurements and machines; electron tubes and electronic circuits; engineering design and drawing; and the subjects classified as the humanities and communications.

Certain personal qualities are required to succeed in electrical technology. Among these are a genuine interest in the field and some mechanical aptitude; although mechanical ability and skill of a tradesman are not needed, a variety of tasks is undertaken with instruments and specialized equipment. A liking for, and proficiency in, mathematics and science are required as well as the ability to express clearly both orally and written. Because supervision is often undertaken, there must be a definite liking of people and qualities of leadership.

As a general rule, most workers in his group find sufficient satisfaction in the interests of their particular field; it is, however, the starting point to a management career with their own company. A small proportion each year take further studies to qualify for membership of the provincial professional engineers' associations. Others set up their own businesses for which their technical training, practical knowledge and supervisory experience give them a good background. They may set up a sales agency for technical equipment, a servicing outlet, or a small manufacturing or contracting business.

Prospects for the future are good. Increasing industrialization of Canada, automation of business and industry, greater emphasis on the better use of manpower—technicians can take over many of the jobs now done by engineers—have greatly increased the demand for more and better trained people in the design, manufacture, installation and maintenance of complex equipment. Until the technical institute program, inaugurated in 1960, is capable of graduating sufficient students each year it is expected that there will be a continuing shortage of technically trained people.

ELECTRONIC WORKERS

Opening of the Montreal radio station in 1920, the first to broadcast regularly in Canada, provided the incentive to start production of electronic equipment and an industry developed largely to meet the domestic demands.

The next year, two companies began production of vacuum tubes and, early in 1922, the first radio receiving tubes were made to be followed by X-ray, transmitting and special tubes and the radio receivers themselves. Later, the principles were applied to other fields and the manufacture of record players and broadcast and communications equipment was undertaken.

With the outbreak of World War II, the industry was rapidly converted to large-scale military output of radar, navigational aids, guidance systems and communications equipment and this rapid development resulted in many new and improved electronic products in the post-war years; for example, 1949 saw the first production of television sets, initially for export but later for the home market.

Until fairly recent times electronics to most people has meant the inside of the television set; with the advent of space vehicles and guided missiles, there is a growing realization of the important effects of electronics on our way of life.

In its more familiar uses, electronics is the basis for radio, television, radio detection (radar), automatic navigation and weather observation. In the defence field, electronic controls are the basis of most up-to-date weapons; ballistic missiles are largely composed of electronic equipment and are controlled by electronic computers while nuclear fission is controlled, guided and recorded by electronic devices. The communications field and the recording of messages, music, statistics, inventories and business records are becoming dependent on electronics. Mathematical forecasting and the field of calculations are rapidly being changed by electronic computers and, in industry, automatic machinery (automation) is dependent on the electron tube for guidance control.

Growth of the industry and widespread use of electronics have led to the development of a group of specialists known as "electronic workers".

This group contains those workers employed in the branch of electrical science where the electrical flow (electrons) is emitted, controlled and directed either through a vacuum, through a gas under low pressure, or along and within the surface of solid electrical semi-conductors (transistors).

While all workers in this group have specialized in electronic theory and practices the degree of knowledge, and the tuition taken to acquire this knowledge, will vary considerably according to the field or industry in which they are engaged. In this booklet, for ease of understanding, they have been divided into those primarily engaged in the servicing and repair of domestic equipment—radio, television and record players—and those employed in the design, servicing, repair or operation of industrial electronic equipment—the computers, automatic controls, guidance systems and communications devices. The first group has been called "radio and television servicemen" and the second, "electronic technicians" but it must be appreciated that there is a considerable overlap and that the titles "serviceman" and "technician" are used interchangeably by employers.

Other types of workers whose duties involve electronics such as industrial technicians, power generation and distribution workers, radio operators and other telecommunications workers are discussed under their respective headings elsewhere in this booklet.

RADIO AND TELEVISION SERVICEMEN

Field of Work

Radio and television servicemen are employed in every community in repair shops ranging from two or three-men businesses, where they often work as partners, to the large shops and service branches of manufacturing companies, department stores and other sales outlets.

Minor repairs and adjustments to home equipment—the radio, television and often the record player or tape recorder—are usually made in a customer's home; complex tests and repairs are undertaken in the repair shops where, incidentally, the more experienced worker is likely to be called an "electronic technician".

Nature of Work

In general, the work of the serviceman in customers' homes includes testing and examination of radio and television sets to determine faults and the necessary adjustment and servicing—tube changing and minor circuit repairs—to put the sets into working condition. In the repair shops, more comprehensive tests are undertaken to analyse the defects. Test equipment such as oscilloscopes, signal generators, voltmeters and ohmeters are used together with electronic diagrams to trace and measure current flow through the circuit components. When a fault is located the repairs may include the replacement of tubes, resistors and other parts and major circuit repairs using handtools such as screwdrivers, pliers, wrenches and soldering irons. When repairs are completed, the set is adjusted to correct operating condition.

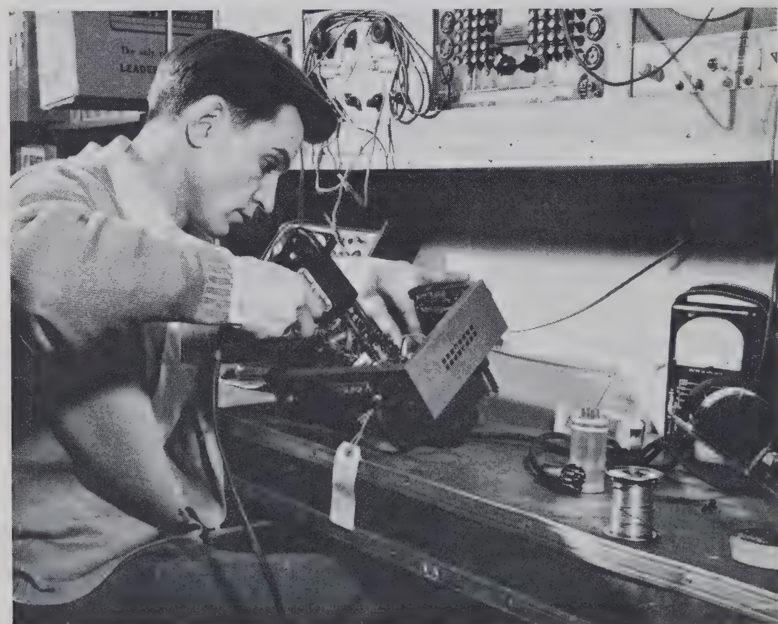


Photo: N.F.B.

Servicemen use a variety of hand tools in their work, including soldering irons.

Personal Qualities Needed

Among the basic qualities that an employer looks for are deft hands, good eyesight (either normal or corrected) and good colour perception which are necessary to work with the small tools and delicate components of the industry. A courteous manner is necessary to preserve good customer relations as is a neat and clean appearance to work in customers' homes. A definite liking for study is a prerequisite—the changing nature of electronics demands that workers continue their studies to keep abreast of new developments.

Preparation and Training

To work in radio and television, the serviceman must have an understanding of electronic theory and principles supplemented by work experience and training. Some servicemen have acquired this knowledge by home study courses and independent reading and, although it is still possible to obtain a working knowledge by this method, the science of electronics is becoming so complex that a more formal kind of study is rapidly becoming necessary.

There are several other ways in which a serviceman can learn electronic theory and practices. One is through a technical or vocational high school program; another is through an apprenticeship scheme, either formal or informal, together with periods of full or part-time study; yet another is by full-time attendance at a post-high school institute of technology.

A number of private trade schools provide basic courses, of about nine months, in electronic servicing; advanced courses are also offered. Evening or correspondence courses are also available, either through private, municipal or provincial schools; this form of training, to be adequate, should include closely supervised workshop practice and is more likely to be of value to those already engaged in this type of work.

Technical and vocational high schools offer courses of approximately three years duration which include electronic theory and practices, mathematics and science. Entry requirements are those of high school although these may be relaxed in special circumstances.

Apprenticeship is a good method of preparation but only a small proportion of servicemen are being trained by this method at the present time. However, apprenticeship is becoming popular with some of the larger companies. In the provinces of Alberta, Saskatchewan and Ontario the trade is regulated by the Apprenticeship Branch of the provincial Department of Labour; the apprenticeship period is three years.

In certain provinces, pre-employment classroom tuition, of approximately one year, is provided in radio, television and electricity for those who wish to enter these fields.

Training in institutes of technology is at a higher level than is usual in high schools and is more likely to be used for entry into supervisory and technician jobs. For this reason, it is discussed with the preparation and training of the electronic technicians.

Because of the changing nature of the equipment, for example, the introduction of frequency modulation, the use of transistors and with colour television just around the corner, servicemen throughout their working lives must continue training. This is accomplished by studying manufacturers' technical publications and by attending demonstrations and lectures sponsored by companies and associations.

Advancement

After several years experience and with sufficient equipment and capital, radio and television servicemen have the opportunity of opening their own business. Other opportunities are somewhat limited and depend on ability and training; some advance to supervisory positions while others move to higher paying jobs in related fields such as manufacturing and communications.

Working Conditions

Servicemen drive to customers' homes and are subject to normal driving hazards; they carry fairly heavy test equipment and spare components and work in home surroundings in whatever space is available. Some heavy work is involved in carrying radio and television sets from the customer's home to a waiting vehicle but perhaps the most strenuous and possibly hazardous work is the erection of television aerials on customers' roofs.

Repair workshops are clean, well-lighted buildings where the major hazard is electrical shock although serious accidents from this cause are quite rare.

In the smaller businesses the hours of work are usually determined by the amount of work under repair. Since a customer requires the minimum of delay in returning a set, often the serviceman works until the set is serviceable. In the larger shops a rotation system with more regular shift hours is possible.

Repairmen answer calls made at all hours, but usually in the evenings, and evening or weekend work is quite common.

Employment Outlook

Opportunities for servicemen in the 1960's are expected to be good. The growth which is taking place in the field of industrial electronics, together with new developments, will create a need to replace those who leave the servicing field for industry. Additional frequency modulation radio outlets, the second television network and increasing use of disc and tape recorders may increase work opportunities.

ELECTRONIC TECHNICIANS

In business, industry and government the term "technician" has a very wide application and there is little agreement on either the jobs or duties. Therefore, in the following paragraphs, "technician" is used in reference to those whose duties require a post-high school technical training, such as is provided at an institute of technology, or its equivalent in experience.

For these technicians, the broad field of work includes radio, television and the communications industries; navigational equipment and guidance systems, both military and civil; and the "Three C's" of office and industry—electronic controls, components and communications.

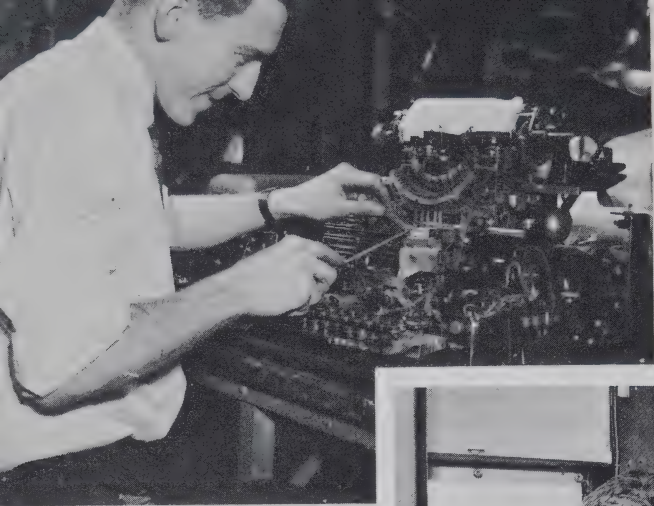
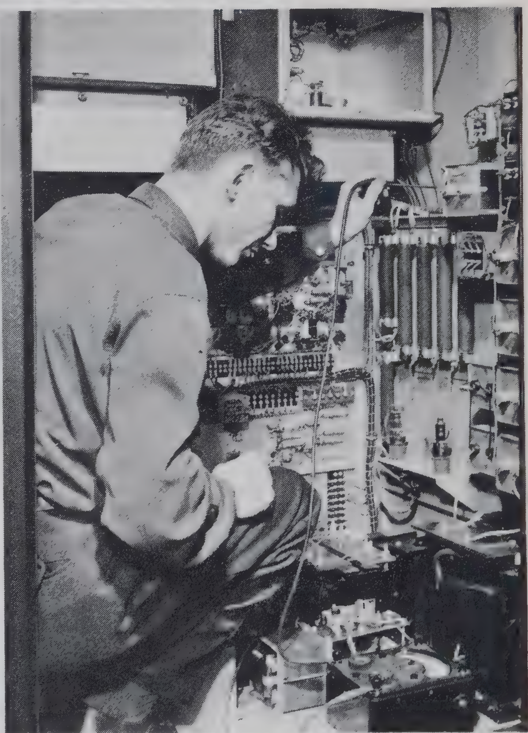


Photo:
Canadian National
Railways



Typical of the many tasks of technicians are the following.-

Above:
Communications technician maintains teletype equipment.

Centre:
Transmitter technician carries out functional tests on a television broadcasting transmitter system.

Bottom:
Radar technicians diagnose faults in electronic equipment.

Photo:
Canadian General
Electric Co. Ltd.

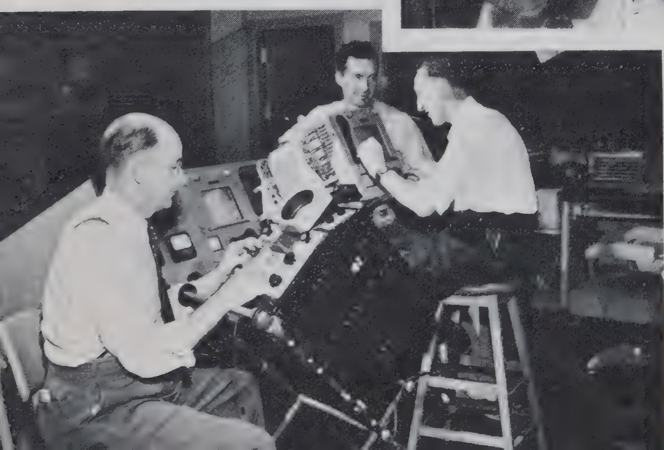


Photo: N.F.B.

Typical of the occupations for the technician are the following.-

Communication technician—installs and maintains various types of communications equipment such as those used by airlines, railways, police and industry.

Customer service technician—installs and maintains highly complex electronic business machines.

Computer technician—inspects, adjusts, repairs and maintains electronic computing devices in industry, business and the Armed Forces.

Computer design technician—assists in the design and development of electronic computing devices.

Field engineering technician—acts as a technical representative and consultant.

Laboratory technician—produces working models of electronic equipment.

Medical electronics technician—installs and maintains the equipment used in medical diagnoses and research.

Radar technician—installs, maintains and operates radar equipment such as is used in aircraft instrument landing, river and harbour navigation and weather recording.

Research technician—builds and tests new equipment in such fields as geophysics, guided missiles, computers and precision testing devices.

Transmitter technician—controls the operation of a radio or television transmitter and assumes responsibility for compliance with federal regulations.

Generating station technician—calibrates, tests and repairs controllers and meters in electrical power stations.

Because of the great variety of jobs, it is possible to give general outlines only of the duties involved. Technicians apply their knowledge in the preparation and interpretation of circuit diagrams, the design of circuits and assembly and installation of electronic units; they supervise the production and assembly of complex equipment; they undertake servicing, maintenance and quality control where the knowledge required is above routine level; in some instances, such as sound and television broadcasting, they may be in charge of the entire technical operation of the station. They may also diagnose faults, conduct tests to verify their diagnoses and make the necessary repairs. Their work calls for the use of equipment such as signal generators, crystal controlled measuring equipment, standing wave slotted lines, oscilloscopes, high voltage test sets and a.c. and d.c. bridges; the tools used are similar to those of electricians.

To succeed as a technician, the entrant must have a genuine interest in the field and some mechanical aptitude. He must have a liking for mathematics and science, the ability to analyse and solve problems and to put theories into practice. Since many technicians are in supervisory groups, the ability to organize and direct other workers is essential as is the ability to express himself, both orally and written. In certain areas, such as broadcasting, a definite creative ability is an asset.

As previously mentioned, the preparation being demanded by employers is that by way of the institutes of technology. At the present time, there are 29 publicly owned institutes situated in six provinces; by 1963 there will be 40 institutes in nine provinces. This growth, among other things, indicates the emphasis being placed on technical institute training.

Courses in technical institutes require three years full-time attendance; however, evening extension courses are available offering technical training at recognized levels. Entrance requirements are usually less rigid than those of universities but the courses are organized for high school graduates. Subjects covered include applied mathematics, applied sciences and electronic theory and practices both by classroom study and practical workshop training; workshop training is designed to familiarize students with the application of principles to industrial use rather than develop manual skills.

On successful completion of the course a certificate is awarded by the institute; at present a scheme is being developed so that the certificate will either carry an interprovincial notation or a second interprovincial certificate may be awarded so that a graduate of any approved institute will be recognized in all provinces.

Not all technicians at the present time are graduates of these institutes. Training has been obtained—and can still be obtained—through vocational schools, correspondence schools and technical schools in conjunction with on-the-job training by an employer. However, the formal education at an institute of technology enables a technician to become productive with only a minimum of on-the-job training and is likely to lead to higher skilled occupations.

Because of the many educational institutions offering courses in electronics, a young person seeking this type of training should use extreme care and obtain the advice of his school principal or guidance counsellor when selecting a school. A number of privately operated schools have been giving electronic courses which enjoy a good reputation; there are others which offer "short courses to high-paid jobs in electronics". While short courses are suitable for a particular purpose, it must be realized that there is no easy or quick method of obtaining the background in mathematics, sciences and electronics which industry now demands.

Technicians, like many other professional and technical workers, usually find satisfaction in their own particular field. The path of advancement is to the more senior positions in their own field but a few, by completing the professional association examinations, qualify as professional engineers. Others may set up their own business such as sales outlets and servicing agencies or a small manufacturing business.

For the future, it is expected that there will be an increasing demand for technicians; at the present time there is a considerable shortage and this is likely to continue until the technical institute program is sufficient to meet the needs of industry. Increasing emphasis on the better use of manpower, advances in scientific knowledge, continued activity in research and development and the automation of business and industry are a few of the factors which point to a bright future for the graduate of an institute of technology.

POWER GENERATION AND DISTRIBUTION WORKERS

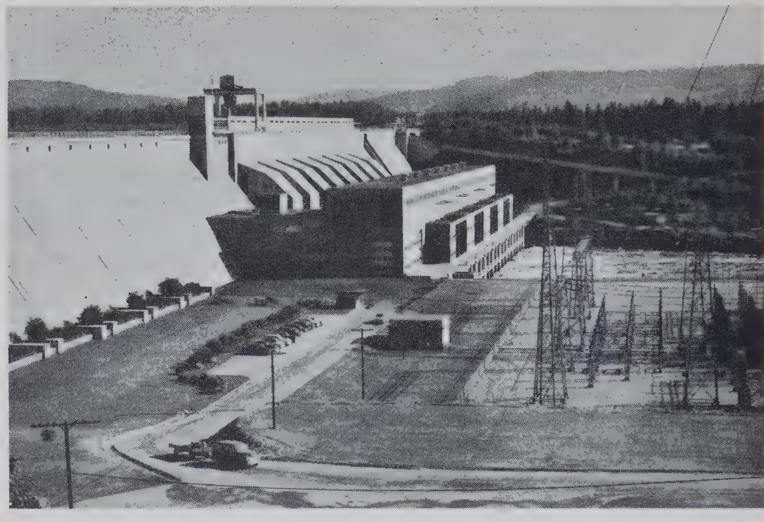


Photo: Ontario Hydro

Des Joachims Hydroelectric plant on the Ottawa River with a capacity of 372,000 kilowatts. The main dam of this eight-unit station is 2,400 feet long.

Canada is extremely well provided with energy potential in many forms—falling water, petroleum and natural gas, coal and wood products, and the more recently recognized minerals which contain tremendous power potential because of their atomic structure.

Increasing amounts of energy potential are being utilized for the production of electric power, in which Canada ranks fourth among the nations of the world. On a per capita basis, Canadians are the world's second largest consumers of electricity.

Harnessing of the more favourable water sites began early—many were developed by 1890 in Ontario and Quebec—and,

about this time, electric generators were introduced. In that year, Ottawa was served with power at generated voltage from nearby Chaudiere Falls.

In 1895, the first year that power was carried any distance at higher than generated voltage, a 17-mile line was constructed in southern Quebec—probably the first long-distance line in the Commonwealth.

Introduction of high-voltage transmission, perfection of the electric motor and the adaption of electricity to manufacturing processes, were contributing factors to the successful early growth of electricity.

Water power development has been rapid, advancing from approximately 178,000 horsepower in 1900 to the 26 million mark by the end of 1960. This total represents less than one third of Canada's potential, estimated to be over 87 million horsepower. Three provinces, British Columbia, Ontario and Quebec, have nearly 90 per cent of the presently developed horsepower.

The many rivers of Canada, with their natural or man-made reservoirs, are the principal source of power and no doubt will retain their leadership for some years to come; being renewable, this source is also the most permanent of our natural energy resources. In 1960, over 90 per cent of the total electric energy was obtained from water power.

Remaining power is produced in thermal generating plants. These are constructed where there is insufficient water power or in areas where water is inadequate during periods of high demand or subnormal river flow; in the latter case, the thermal stations are used as standby sources.

More recent developments include high-voltage transmission systems which, when perfected, will be used to bring power from hitherto untapped regions to populated areas, an experimental atomic power plant now installed on the Ottawa river and another being built at Port Elgin, Ontario.

FIELD OF WORK

Electrical power reaches into almost every locality and employment will be found in communities ranging from rural areas to heavily populated cities. There is a concentration of jobs in the larger centres to meet the demands of industry since main population areas are usually heavily industrialized, and because they are often the location of the power utility headquarters.

There are three main fields of technical work—power generation, power transmission and distribution and maintenance—and the following brief description of how a power utility company operates may provide a clearer picture of the occupational groups in the industry.

Generation is the first step in the production of electrical power. Large turbines, supplying mechanical energy and connected to generators which convert this mechanical energy into electrical power, are driven either by falling water—this is called "hydroelectric" power—or by steam from boilers with coal, oil or gas as the fuel—called "thermalelectric" power—or, in the future, steam will be obtained from nuclear energy as the source of heat.

Generation is the field of work for supervisors, operators and other workers who observe and check the turbines and generators and the associated equipment. Groups of workers known as switchboard operators, control the power in the generation circuits and on to the high-voltage, transmission lines.

Transmission and *distribution* of power outside the generating plant is through transmission and distribution lines, carried on overhead towers or underground in insulated cables, and linking the generating plant to the network serving the consumers; this is the field of work for the systems and load dispatching group who match the amount of generation to the consumer load demand. The lines transmit power to substations and may also serve to link several generating plants so that the power can be interchanged to meet fluctuating demands.

At the substations the generated power, which has been previously increased in voltage by "step-up" transformers in the generating plants, is reduced by "step-down" transformers before entering the distribution network. Control of the transformer sub-

stations is the field of work for substation operators and their assistants.

In the distribution network, the voltage is further reduced by banks of transformers in a distribution station before reaching the final consumer. Distribution stations are often unattended but in some instances may be under the control of local operators.

Transmission and distribution is carried out through a network of wires to the final consumer and this is the field of work for those maintaining and constructing the lines—the linemen, cable splicers and their helpers.

Supervising the whole field of generation, transmission and distribution is the area of work for the systems and load dispatching groups who act as co-ordinators in the many activities necessary from the generation of power through transmission and distribution to the final consumer.

NATURE OF WORK

Generation—Hydroelectric Power

Supervision of the generating station is handled by a superintendent or chief engineer and the supervising operators under his jurisdiction. Below the chief operators are the assistants, operators-in-training and wheelmen, who assist the operators.

Flow of water to the turbines is controlled by headgates located in the headworks of the station and also by gates which form part of the turbine structure. Headgates are generally opened or closed by a gatehouse man or headwork operator as directed by the station operating staff.

Controlling the operation of the turbines, as directed by the senior operator, are workers variously known as operators-in-training, floormen or wheelmen who start, stop and tend the turbines and associated equipment and also regulate the gates controlling the flow of water through the turbines.

Photo: Gatineau Power Co.

Interior of Paugan Hydroelectric plant showing the generator units.

One or more *control operators*, working on a shift basis, direct and operate the generating units and associated equipment and record operating data; they are also responsible for the isolation of various units, such as generators, prior to servicing operations.

The "nerve centre" of the whole operation is a control room where *switchboard operators* regulate the output of the generating units using controllers on a remote panel according to demands made by the systems or load dispatching group—their function is explained when transmission is discussed. In some plants, both hydro and thermal, switching duties may be combined with other plant duties such as generator operation.

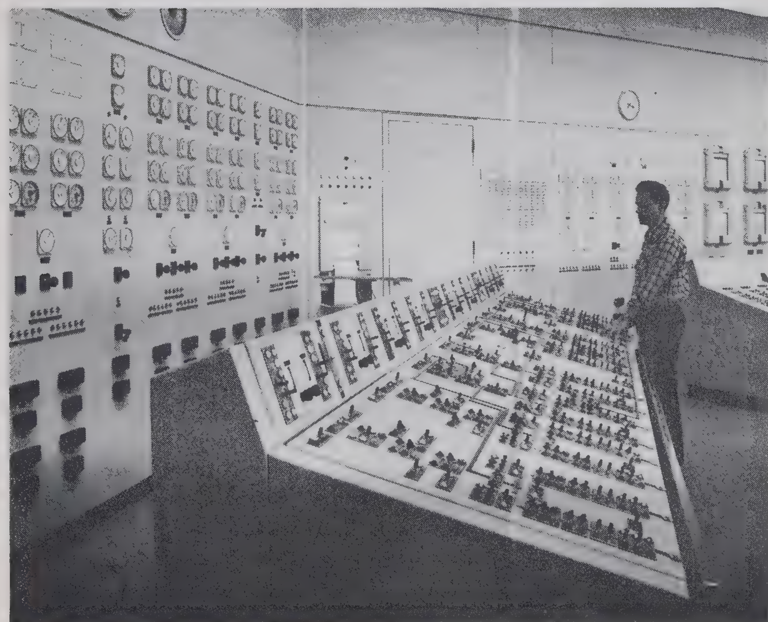


Photo: N.F.B.

Control room and switch panels — both generating plants and substation controls are similar.

As in hydro power generation, a plant supervisor (chief engineer or superintendent) has overall responsibility for the operation and maintenance of the complete plant.

There is an important occupational difference between thermal and hydro generation. In thermal stations, the steam-operated turbines and boiler equipment are controlled by employees who are qualified as stationary engineers by provincial examination: in hydro stations, mechanical energy to turn the turbines is supplied by falling water and stationary engineers are not employed.

Some general ideas of the four classes of engineers, their alternative titles and possible certification are given in the following paragraphs:-

Chief engineer (chief operator)—First-class Stationary Engineer's Certificate—in charge of plant operation.

Shift engineer (power-plant operator)—First- or Second-class Certificate—is responsible for the operation of boilers, steam turbines, pumps and associated equipment.

Assistant shift engineer (turbine operator)—Second- or Third-class Certificate—controls the operation of the turbines and generators and records readings, checks turbine speeds, bearing oil pressures and water coolers and starts or stops the turbines and generators.

Firemen (boilerman or steam-plant utilityman)—Fourth-class Certificate—regulates the boiler supply of fuel, water and air to maintain desired steam pressure.

Auxiliary equipment attendants take care of coal pulverizers, water purifiers and evaporators; these are starting positions and certification is not a condition of entry.

Control of the generators and the regulation of power output to the transmission lines on thermal stations are similar to that described for hydro stations.

Transmission and Distribution

Transmission of power to the transformer station, to distribution centres and also to separate systems for interchange of power, is the responsibility of a load dispatching group supervised by a *systems superintendent,* also known as a chief load dispatcher, whose duties form the link between the generation and transmission of power. He prepares, or receives, estimates of power requirements and issues instructions to load dispatchers and operators.

Under his supervision, a *load dispatcher* (systems operator) allocates the required power output among the generators and generating plants, controls the flow of current throughout the systems and connects the output of several systems as required. He may also control the flow of water to the various stations within a power system.

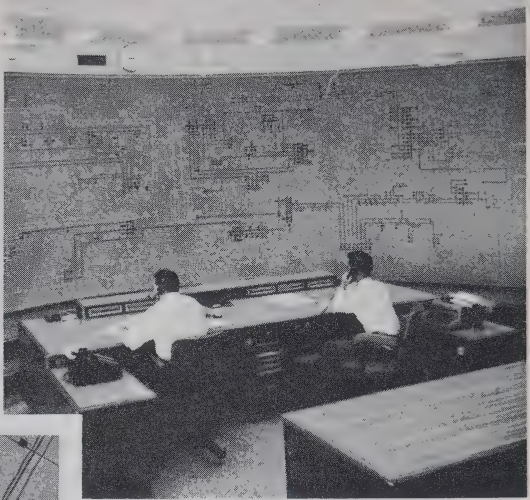
Voltage entering a substation where it is stepped down, or other distribution centre, is controlled by a *substation* or *transformer station operator* who, together with other operators on his shift, also directs the outgoing voltage from the substation to the distribution lines using switchgear and similar controls.

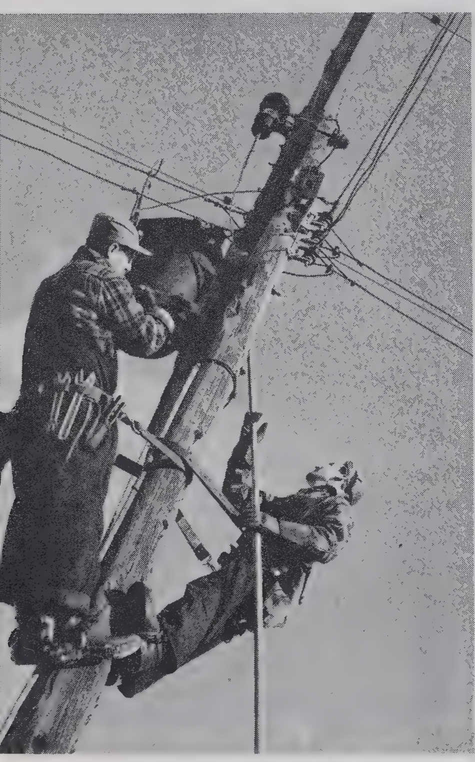
Several types of workers are employed in the maintenance and construction of overhead or underground wiring. A *lineman,* usually as a member of a small crew, undertakes such work as repairing damaged lines and equipment, conducts periodic examinations for signs of defects and generally assists in the training of new personnel. Steel-tower work is also carried out by linemen. Serving as a helper to the lineman is the *groundman* or lineman-learner who handles materials, digs holes and hoists poles into position; he may also perform specialized duties such as truck driving and winch operating.

Joining of cables in underground or overhead installations and of related equipment is the job of the *cable splicer* although in some companies, this work may be undertaken by an electrician. He joins corresponding conductor wires at cable junctions, wraps insulating material around the connections and, using hot lead, seals the joints.

Systems and load dispatching office.

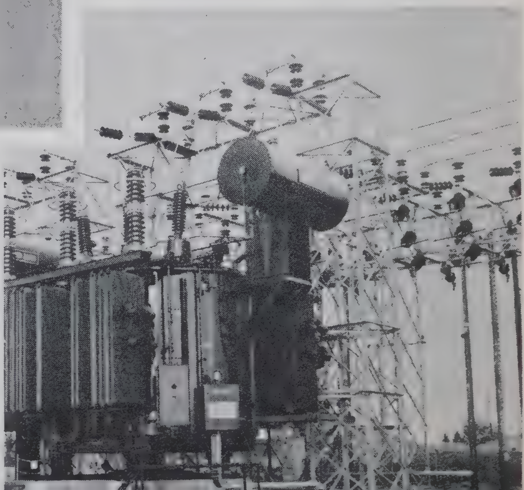
Photo: Shawinigan Water & Power Co.





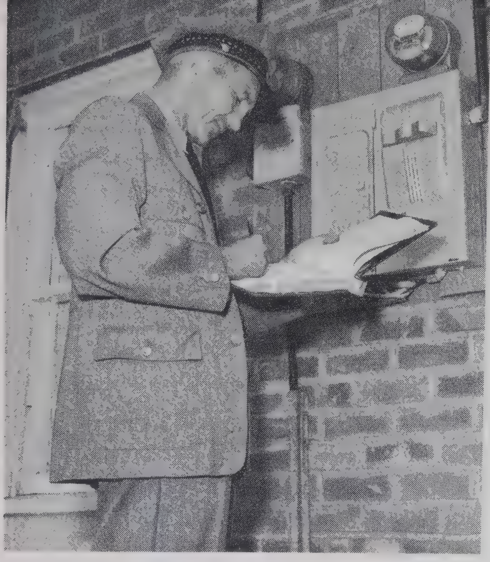
Linemen . . . note tools and equipment carried.

Photo: N.F.B.



Substation near St. Jerôme, P.Q.

Photo: Gatineau Power Co.



The meter reader records electrical consumption for billing purposes.

Photo: Shawinigan Water & Power Co.

Electricity used by a consumer is metered before use. Installation and testing of these meters in domestic premises is the work of *metermen* who may specialize in one phase of work and be called meter tester, meter installer or meter repairman.

At regular intervals, a *meter reader* notes the amount of electricity consumed on customer's premises and records the consumption for billing purposes. He also reports equipment defects and changes of location.

In many rural areas, companies employ a *district representative* or rural serviceman on duties which, in urban centres, are carried out by specialized personnel. These duties include meter reading, accounts collecting, the connection and disconnection of meters and some repair work.

Employed in some companies are *appliance servicemen* who install, maintain and repair electrical equipment and appliances. This work requires an all-round knowledge of general appliances and may require a specialized knowledge of refrigeration.

PREPARATION AND TRAINING

New entrants in the power generation and distribution fields are trained by working on the job in a series of progressive steps of increasing responsibility as knowledge and ability warrant. Certain tradesmen such as electricians (refer to the ELECTRICIAN section in this booklet) and machinists have formal apprenticeship training; electrical engineers have graduated from university or completed courses laid down by their professional association.

With the exception of apprenticeship trades, no particular age limits are stipulated but some companies have an upper limit of twenty-five years. Educational requirements range from two years of secondary school to high school graduation or its equivalent of vocational training.

Training methods vary with the power utility company, the size of the station and its location. Typically, from three to four years of on-the-job training exclusive of a six-month probationary period, is given under the supervision of an experienced worker supplemented by vocational studies either in a company school, vocational school or by correspondence.

The entry occupation to the operator position, in larger companies, may be that of second floorman who advances as openings arise on seniority and demonstrated ability through first floorman—assistant operator—second operator to first operator. In other companies, the floorman and assistant grades may be combined under the title of operator-in-training. During the training period, entrants may be moved to different stations for familiarization with various installations.

Linemen are trained by working on the job under the guidance of an experienced worker and given tuition in company-operated schools. Some entrants also take advantage of related courses in vocational schools or by correspondence. The entry occupation may be that of learner although in certain provinces—British Columbia, Alberta, New Brunswick, Nova Scotia and Newfoundland—he is considered an apprentice. As an apprentice, short periods of full-time study at a vocational school, or its equivalent in part-time study, may be required during each year of the apprenticeship.

Cable splicers start as helpers or, in some provinces, may be selected from the linemen group. Again training consists of work under the experienced cable splicer's supervision and some classroom study. Alternatively, where cable splicing is part of the power electrician's duties, he is trained by his company in the required techniques.

PERSONAL QUALITIES NEEDED

Because of the nature of the work, where continuous, efficient service to consumers and the safety of fellow employees are important factors, and where an operating error could cause untold damage, the qualities of dependability, initiative and self-reliance are of major importance. Ability to work with others is necessary since most of the duties are undertaken as part of a team.

Good physical condition is required in most positions, but is particularly important to linemen and similar jobs where the work involves climbing and handling heavy towers and poles under all weather conditions. The lineman must have a good head for heights and a keen sense of responsibility to work on major installations—these may carry one quarter of a million volts of electricity.

District representatives, and those whose duties take them into domestic and business premises, need a neat, clean appearance and friendly manner to maintain good customer relations.

ADVANCEMENT

For the operating staff, the path of advancement is one of progression within the company to more responsible—and higher paying—positions as seniority and experience warrant.

Some utility companies take men from smaller stations and transfer them to operating positions at larger stations. Stations are graded according to size, design and importance. Advancement, with increased responsibility, may be from the lower grade to a higher grade station where the operations are more complex; at least five to seven years' experience is required to reach operator positions at the highest grade of station. Load dispatchers are selected from the more experienced operators in higher grade

stations. A minimum of seven to ten years as a senior operator is necessary for promotion to regional dispatcher; to fill a vacancy not only is experience required but also a complete knowledge of the entire utility system. The years required to reach senior positions are often much longer because of the relatively low turnover of labour in the industry.

Advancement for linemen and cable splicers is limited; a small proportion reach foreman status.

WORKING CONDITIONS

Generating plants are well-lighted buildings and are clean and orderly. Even steam plants, with the exception of a few older ones, are clean as the fuel is handled by mechanical equipment. Generators are housed in clean, airy rooms but there is considerable noise from rotating equipment.

Operators are often seated at control panels and rarely is much strenuous activity or lifting required.

Since stations operate on a 24-hour, 7-day week basis, workers in generation, substation and load dispatching have an 8-hour rotating shift schedule including nights and week-ends. Linemen and maintenance workers usually have a standard week but often work overtime on routine or emergency repairs.

It should also be pointed out to those with strong home ties that during training, and on advancement, operators are moved from one district to another as openings occur; also, that generating stations may be in isolated and remote areas.

In substations, work is indoors in similar surroundings to those of the generating plants.

Linemen work outdoors in all kinds of weather and must do a considerable amount of tower and pole climbing and the handling of heavy materials. Cable splicers and their helpers work in manholes beneath the streets—often in cramped quarters—and use molten lead.

The accident rate compares most favourably with that of other industries due to the institution of safety practices by the companies in co-operation with provincial authorities and the trade unions. Workers in some occupations are more prone to accidents than others; accidents, such as falls and electrical burns are more likely to occur among the line and cable crews. Around generating plants, failure to observe safety rules while working with high voltages, could be dangerous to life. However, because of the rigid enforcement of safety practices, such accidents are quite rare.

ORGANIZATIONS

The majority of non-supervisory workers are covered by union agreements and represented by affiliates of national or international unions or by independent unions and employee associations. Two of the larger unions are the National Union of Public Service Employees and the International Brotherhood of Electrical Workers.

EMPLOYMENT OUTLOOK

During the 1960-70 decade, considerable increases in electrical power capacity will be made. Forecasts vary but an average annual increase of over two million horsepower is predicted with marked increase, in some provinces, in thermal generation.

However, because of factors which will be explained, although there will be growth in the number of workers employed, the increase will be less than the forecasted doubling of electrical capacity.

By increasing the amount of instrumentation, with larger and improved control systems, and improvements in plant design and lay-out, more units of electricity will be produced by the same number of workers; offsetting this will be the need to replace those who retire or leave the industry for other reasons.

With these factors in mind, it is anticipated that there will be a steady rise in the number of employment opportunities over the next decade.

There will, however, be differences in the rate of growth in certain occupations. Maintenance workers, for example, will increase at a faster rate than other groups because of the increased amount of equipment used in the newer stations. On the other hand, the trend towards the building of larger and unattended stations will reduce the need for operators. To construct and maintain the growing amount of transmission and distribution lines, employment for linemen will be accelerated. In certain areas, alternative methods of cable splicing in place of the "hot-lead" method are being used; these reduce the need for cable splicers and it is expected that an increasing amount of cable splicing will be undertaken by journeyman power electricians.

Introduction of atomic power will not greatly affect the employment picture for operators; generally, the same number and types of generating and transmission operators are required for all thermal plants.

TELECOMMUNICATIONS WORKERS

Communications in Canada have been shaped to meet the familiar challenges of the country—the vast size, topography, variable climate and widespread population.

Through the combined efforts of the railways, telephone companies and government departments, great networks of communications have been set up. Co-operation between these enterprises has also provided Canada with defence systems—the Mid-Canada Line is but one example of the joint efforts of the telephone companies and government agencies.

Although vital and useful communications services are currently being provided by the operating companies, the media of communications are under constant change and development. In the following pages, for ease of understanding, Telecommunications have been divided into sections, each section covering a particular field. However, this division has almost disappeared and there is now considerable overlap between the activities of the various companies. For example, the telegraph departments of the railway companies have evolved from the provision of relatively simple telegraphic services to a complex telecommunications operation through which they provide—in addition to telegraphs—teleprinter, Telex (an intercontinental dial teleprinter service), radio and television, facsimile and data transmission networks. Also, the telephone companies are no longer exclusively concerned with telephone services and have diversified their activities in the same way as the telegraph companies.

As in all large organizations, the communications field offers careers in many types of work. This booklet, however, is confined to those occupations which require a technical skill, to a greater or lesser extent, in electricity or electronics. Details of related occupations—telephone operators, teleprinters and teletypists—are included in the OFFICE OCCUPATIONS monograph in this series.

TELEPHONES

Invention and development of the telephone are of particular interest to Canadians since it had its origin in this country. Alexander Graham Bell himself fixed the date and place of the invention in the summer of 1874 at his father's farm in Brantford, Ontario. It was two years later that the first successful long-distance telephone message was sent from Brantford to Paris, Ontario—eight miles—over lines lent by the Dominion Telegraph Company.

Since that time growth of the industry has been rapid and continuous. The first dial system was opened at Whitehorse in the Yukon in 1901 and the first exchange in a metropolitan area, Toronto-Glover, in 1924.

More recently, 1927 saw the introduction of overseas telephone service via radio; 1932 the founding of the Trans-Canada Telephone System; 1956 the first trans-Atlantic cable; and Direct Distance Dialling in 1958. In the same year, the Trans-Canada Telephone System completed the world's largest single microwave network which spans Canada from coast to coast and capable, in its ultimate form, of carrying more than 2,400 long-distance conversations and two television programs at the same time.

Many telephone systems provide service across the country; they number more than 2,500 and range in size from large shareholder-owned companies to small co-operatives in rural districts. The Bell Telephone Company of Canada, operating through the greater part of Ontario and Quebec, serves over 60 per cent of all the telephones in the country. The British Columbia Telephone Company serves about ten per cent of the total. Four private companies cover the Atlantic provinces and three provincially owned companies serve the Prairie provinces. The eight largest systems are associated in the Trans-Canada Telephone System to furnish all-Canadian long haul communications services on a nation-wide basis.

In addition to providing telephone services, the industry is engaged in other communications activities such as data transmission, mobile telephone services and in bringing television programs from remote locations to station transmitters.

About twenty-six and a half million telephone calls are made in the average day over some six million telephones in Canada. Maintaining the switching centres for these calls, keeping the existing lines and equipment in good order, installing new equipment and performing the many functions for the running of this large and complicated industry—all these are the work of the technically trained personnel described in the following paragraphs.

Field of Work

Telephone jobs are found in almost every community. However, the largest numbers are in cities and towns where population and business and commercial enterprises are concentrated.

There are three main fields of technical work—central office, overhead wires and cables, and station installation—but, for ease of understanding, it is necessary to have some brief ideas on how a telephone system operates. Although the following paragraphs discuss the fields separately, it must be appreciated that two or more jobs are often combined in smaller companies and that workers move from one group to a higher group as the normal path of advancement. Often workers may have different occupational titles, depending on the company; the most frequently used title is given in the following paragraphs with the alternative in parenthesis.

The field of work for the *central office craftsmen* is the nerve centre of the whole operation, known as the "central office" which contains switching equipment through which any telephone can be connected to any other telephone.

Each time a call is made it travels from the caller along wires and cables—these can be seen overhead in most streets—to a vault in the basement of the central office.

From the vault, many thousands of wires, in pairs, fan out on a distributing frame from which each pair of wires leads to either a switchboard or to dial equipment. To join the caller's telephone to the telephone being called, connections are made either manually by an operator at a switchboard or automatically through electrical switches and relays on a frame. Maintenance of this complicated equipment is the work of the central office craftsmen group.

For the *linemen group*, the field of work is the country-wide network of wires and cables which connects the subscriber's telephone to the central office. Usually these wires are carried overhead on telephone poles but, particularly in larger cities, they may be underground.

Station and PBX installation and repair groups are employed in the third field of work. Station installers are the workers who put telephones in homes and businesses. Some telephone users make and receive so many calls that a single line could not handle the traffic. To take care of these calls, a system similar to a miniature central office is installed on their premises. This system is a private branch exchange, known as a "PBX", and will be found in commercial buildings, government agencies and manufacturing establishments. A function of this group of workers, as the name implies, is the installation or repair of this equipment.

Nature of Work

Central Office Group

Employed in the central offices are craftsmen who test, repair and service the dial and automatic equipment. This group, which is concerned with the prevention of breakdown and the repair of faults, is made up of several occupations at differing levels of skills.

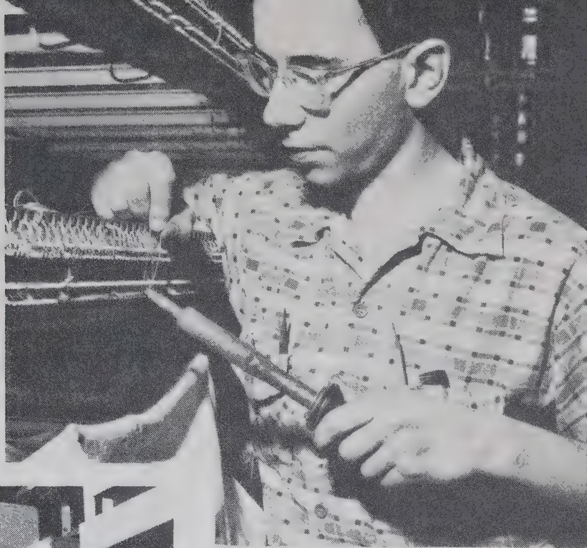
A *frameman* is often the entry occupation in the central office. Working to drawings, or to the foreman's instructions, he connects outside cables to the distributing frame and makes soldered or other connections. Also he may assist in testing and repair.

A *tester* (or testman), one of the more experienced workers in the group, makes periodic efficiency tests to avoid interruption of service. Using test equipment, the tester checks the components of the system and services suspect equipment before a breakdown occurs. However, should a breakdown occur, he has to locate the trouble spot and may report to or dispatch maintenance workers to the location of the fault.

A *central office repairman* (mechanic or switchman) is responsible for the maintenance and repair of the switching equipment in the central office. Using gauges and tools, he checks switches, relays and other equipment and makes adjustments and repairs.

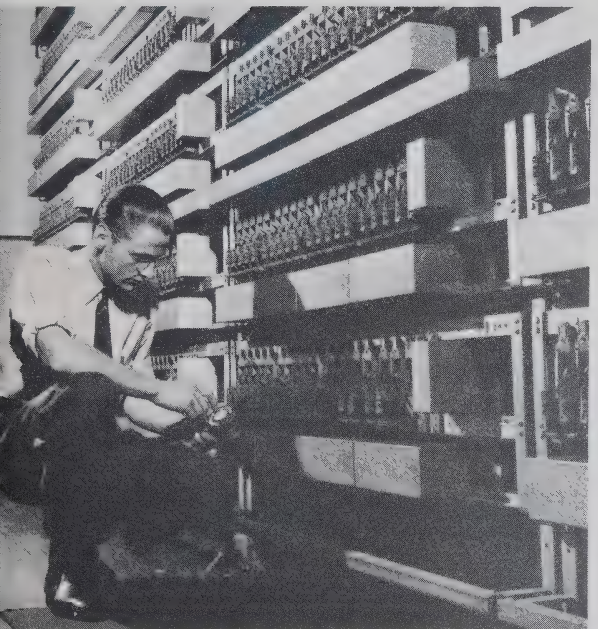
Photo:

David Bier, Montreal



A frameman in a Bell Telephone central office.

Photo: N.F.B.



Central office switchman in the Alberta Government Telephones.

Cable splicing in the Bell Telephone Company.

Photo: Malak, Ottawa

Often he works with the tester in locating trouble and he may also maintain private branch exchanges, teletype and similar installations.

Linemen Group

Installation, maintenance and repair of overhead wires and cables leading from a subscriber's line to the central office are the duties of a crew consisting of *linemen, cable splicers, groundmen* and their assistants.

Linemen and groundmen normally work as members of a small crew which moves from one assignment to another under the direction of a foreman. They may work on poles with wire or cable, or on underground cables. Their job may include such tasks as digging post holes. In recent years the increasing use of power-driven, post hole diggers has made this job less strenuous.

Entry to the cable splicer's job is by working as an assistant to a cable splicer who prepares, tests, makes and inspects cable joints.

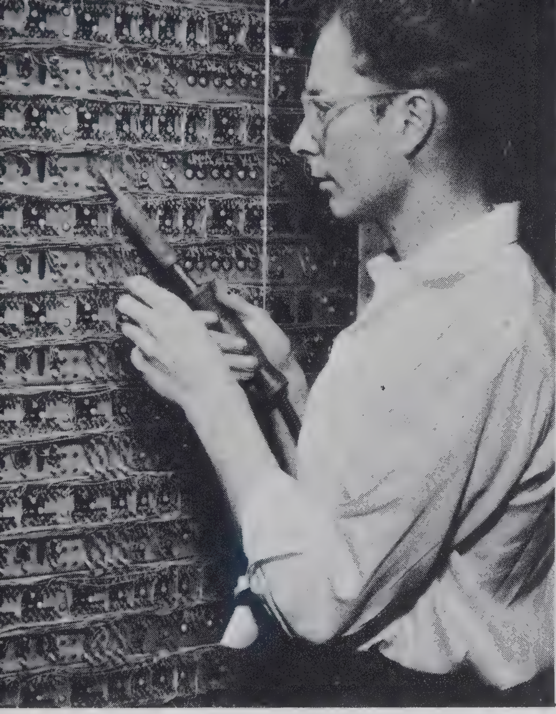
Station and PBX Group

Installation and servicing of telephones and private branch exchanges on subscriber's premises and making repairs when trouble develops are the main duties of this group.

Their duties—and their field of work—vary considerably. They may add an extension to an existing line in a private residence or replace an old style telephone with the latest model; they may install mobile radio-telephones in a fleet of vehicles, a teletype system in a business office or a multi-line system in an industrial establishment. However, in all cases they are working in contact with the public, with a minimum of supervision.

Personnel in this group may also specialize in a certain type of work, particularly in the larger companies, and may be known under the following occupational titles.

A *telephone installer* (station installer) changes, removes and installs telephones, switching equipment and wiring in homes, pub-



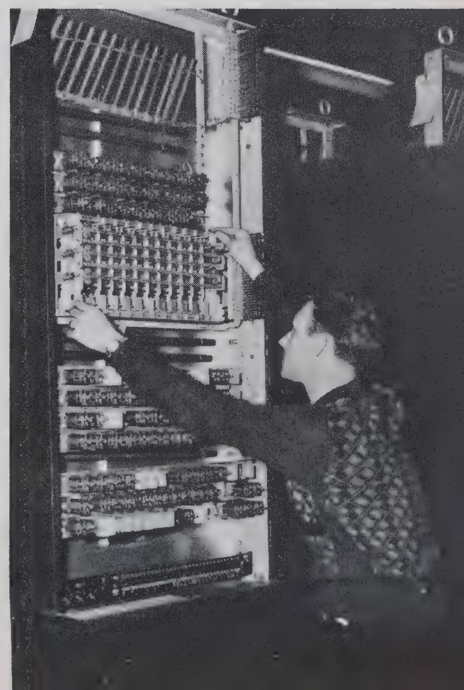
Repair work on an hotel PBX installation.

Photo:

Michael Burns, Toronto

The essential elements of a Bell Telephone PBX installation.

Photo: Arnott & Rogers, Montreal



lic telephone stations, business establishments and industrial premises. On new installations, connections are made between the telephone and wires on nearby buildings or telephone poles. For this purpose they may be required to climb the poles or ladders.

A *telephone repairman* (station repairman) in conjunction with a central office tester, adjusts and repairs telephone and associated equipment.

Both installation and repair work may be combined and, in this case, undertaken by a *telephone* or *station installer/repairman.*

A *PBX installer* undertakes similar duties to those of a telephone installer but the work is of a more complicated nature. He installs private branch exchanges and associated equipment on subscriber's premises, connects wires from terminals and switchboards and tests the installation. His work also includes the setting up of teletype and special equipment such as that used for mobile radio-telephone units or radio and television broadcasts.

Maintaining the installed equipment is the work of *PBX repairmen* or, in some exchanges, combined installation and repair work are undertaken by a *PBX installer/repairman.*

Central office equipment is installed by *equipment installers* who may be employed either by the telephone company or the equipment manufacturer. Their work not only includes new installations but may also include adding to or extensions of existing systems.

Other technical personnel include those with radio training such as radio attendants and microwave technicians who test, service, maintain and repair radio, electronic and associated equipment used in the telephone industry.

Personal Qualities Needed

Certain personal qualities are required for all types of telephone work including:-

A *keen sense of responsibility*—poor workmanship is bound to cause inconvenience to subscribers; breakdown of emergency services, such as those used by ambulance, fire and hospital services, could lead to fatal results.

Good eyesight, either normal or corrected, and good *colour vision*—telephone wires and equipment, often quite small, are identified by colour codes.

Ability to study and an *active interest* in new developments are necessary—the telephone industry is engaged constantly in the improvement of services and this involves frequent changes in techniques.

Other qualities, although needed for most telephone work, are more essential in certain work areas.

For central office work, dextrous hands are required since the work is often undertaken on extremely fine wires and small components. In addition, the worker must be painstaking and methodical to prevent breakdown; he must be able to think and act quickly should a breakdown occur, so that the service is restored with the minimum of interruption.

For the PBX and telephone installers, a neat appearance and pleasant outlook are necessary since they often work in contact with subscribers in their homes, offices and business premises.

For the linemen a good physique is required. Their work involves the handling and climbing of heavy poles and ladders under all weather conditions. A good head for heights is needed to work on overhead installations.

Preparation and Training

Telephone companies hire inexperienced workers between the ages of 17 and 25 and prepare them by on-the-job training and classroom tuition.

Educational requirements depend on the company and the field of work. Larger companies require from two years of high school for linemen, ranging to four years of high school or the equivalent technical training, particularly in mechanical and electrical subjects, for entry to central office trades. Often a knowledge of electronics is an asset. In general, the higher the formal schooling on entry, the better the chances of benefiting from company school courses which must be taken before advancement to a higher grade of work is possible.

Training methods have been designed to meet the needs of each particular company and vary to some extent in different provinces. Programs usually consist of an initial period in a company-operated school followed by continuous training by a foreman or other experienced man while working on the job. Further classroom courses are given to prepare ambitious workers for advancement to higher grades—and higher paid positions—when new methods are introduced. It may be mentioned that new entrants are known variously as assistants, helpers or apprentices depending on the province and the company for which they work.

To give some general ideas on the type of training to be expected, the program of a larger company is given in the following paragraphs but it must be borne in mind that many local differences exist.

New entrants to central office work may commence with an initial dial switching course of about four weeks in the company school, then work with an experienced man. Further training and classroom tuition is given depending on progress and advancement.

A lineman may spend one or two weeks in classroom study before going on to further training under the direction of the foreman.

Splicers start as helpers on the job and may take some classroom study in the company school; to become fully proficient may take two to three years of on-the-job training.

Longer periods are spent in classroom study by the installers—usually five to six weeks. Further training again depends on individual progress and advancement.

Since technological changes are continually being made in the telephone industry, it is the practice of companies to send employees to training schools from time to time and also to move them from one job to another to gain additional experience.

Advancement

Due to the specialized nature of the telephone industry, the upper positions are filled by promotion of workers from within the company as vacancies occur. For example, after experience the

central office man can qualify as a foreman, one of the starting points to a telephone management career; a lineman may be transferred to other telephone crafts or, after considerable experience, can qualify as a line foreman, again one of the starting points to management; station installers are promoted, as ability warrants, to station repair work or may follow the craft route—central office, PBX installer or repair, tester and foreman.

Working Conditions

Working conditions depend on the group in which the worker is employed. Central office workers are in clean, well-lighted buildings. Linemen work outside in all but the most inclement weather and with a high proportion of heavy tasks; they are exposed to the hazards of working aloft but these are greatly minimized by safety equipment and practices. Cable splicers also work outside, either aloft or in manholes underground, using hot solder. Station installers are exposed to the weather part of the time and are subject to the normal hazards of driving a vehicle.

An 8-hour, 5-day week is general throughout the industry. However, since telephone services are provided on a 24-hour basis, certain workers such as central office men work day, evening and night shifts and also on the week-ends. Linemen and splicers may work away from home and be called out in an emergency.

Wages, hours of work and other conditions are included in collective agreements negotiated between the companies and certified unions.

Organizations

Non-supervisory employees are members of employee associations such as the Canadian Telephone Employees Association or national or international unions such as the International Brotherhood of Electrical Workers.

Employment Outlook

During the 1960-70 decade, it is expected that most employment opportunities for craft workers will result from the need to replace those who retire or leave the industry for other fields. However, since most telephone workers have chosen this industry as a career,

there is relatively low turnover of labour, thus vacancies arising from the latter reason are low. An increase in the number of openings in craft jobs is expected as the industry expands and also by its use of more complex equipment.

With an anticipated expansion in the economy, together with growth of population, the demand for additional telephone and allied services is expected to increase and this, in turn, will result in some growth of employment. However, this growth will be at a slower rate than the expected increase in the number of telephones. As in the past, the industry will provide an increasing amount of service per employee because of technical improvements.

Extension and improvement of local and long-distance services continue to absorb the bulk of invested capital and labour; with growth of the economy and its northward-reaching tendencies, the telephone companies are being called upon to supply communications services to many new and important centres of development. Growth of population results in additional households as well as increases in the number of business and industrial establishments—all these require telephone services.

Other indications of future expansion include the introduction of many new features such as interphone systems, automatic call distributors, mobile telephones, data transmission and call directors.

As in most technical fields, work in the telephone industry is becoming more complex because of technological changes. For example, due to automation, central office work is becoming more complicated; the installer has many of the previously mentioned new features to provide; and, with the advent of plastic sheathed cables, the lineman will undertake cable splicing as part of his duties. These changes mean that new entrants will require more education than formerly—high school graduation or the equivalent—to master the technical aspects of the industry.

TELEGRAPHS

A new era of rapid communications began with the advent of the telegraph. Samuel F. B. Morse's many years of experiment culminated in the transmission of the first message—"What God hath wrought"—in May, 1844. This was quickly followed by the introduction of the telegraph for commercial purposes.

Canada was not slow to realize the possibilities of this new method of communication for, in 1846, the first telegraph messages were exchanged between Toronto and Hamilton. The next year, lines were laid between Queenston and Niagara and thence to the United States, and between Hamilton and London.

Many telegraph companies were formed throughout the years but amalgamation of competing lines constantly took place until today the Canadian telegraph network consists of nine companies. Large networks are operated by the telecommunications companies of the Canadian National and the Canadian Pacific Railways who, in addition to operating systems for their own use, also supply these services to the public. The Canadian Overseas Telecommunications Corporation, a Crown agency established in 1950, is responsible for most of the overseas communications.

Numerous flexible services are provided to industry, brokerage houses and news syndicates who find it desirable to operate their own telegraph systems over lines leased from the telegraph companies. Thus, stock quotations are carried across the country and fed to ticker tapes in stockbroker's offices; news events are relayed through the telegraph systems and printed on tapes or by teleprinter in city news rooms; radio and television programs are relayed to distant or isolated districts.

Since the Morse code era, many technological changes have taken place and messages are now sent by "teleprint", "teletype" and "multiplex" systems over land lines or radio circuits including microwave links.

Field of Work

Employment in the communications field will be found throughout Canada; in almost every district there are offices of the telegraph (telecommunications) companies.

The following brief description of message transmission will provide a general idea of the field of work and the various occupational groups in the industry.

Each communications system is divided into networks; within each network, and situated in a main city, is a control headquarters. Messages originating in any district of the network are transmitted, either manually or by automatic methods, to a control room (switching centre) in regional headquarters. In the switching centre, the message is passed by hand, or switched, to outgoing lines and either through further regional headquarters or directly to the terminal office.

In manual operations, a message would be sent over land lines by a telegraph operator, using a morse code key, to the switching centre where it would be redirected into an outgoing channel. From this point, the message would again be carried over land lines and transcribed at the terminal office before being telephoned and then delivered by messenger to its destination.

The length of land line over which messages can be sent is limited in that there is a weakening of signal strength by resistance of the lines. It is therefore the practice to divide long telegraph circuits into sections, each section being combined by a repeater station whose function is to maintain signal strength.

This brief description is, however, telegraphy in its simplest form and while some use is still made of manual operation, many developments have taken place.

Development has been in two main areas; one is in automatic methods of originating message signals and the other, the type of "carrier" over which messages are sent. Also of prime importance are the design and installation of customer-operated equipment for special purposes.

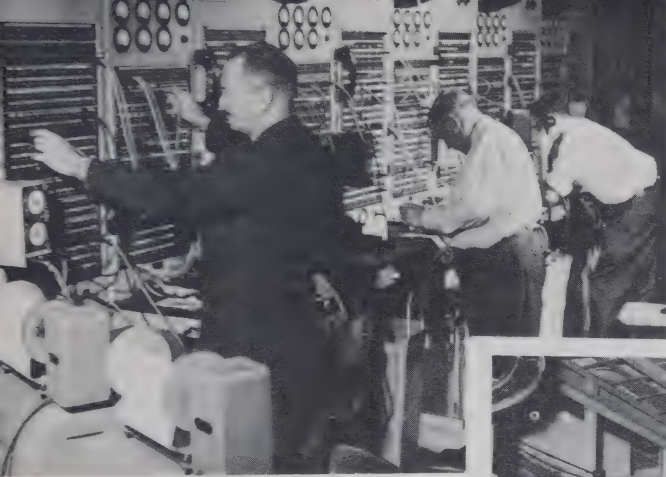


Photo:
Canadian National

Above:

This equipment acts as the "nerve centre" for the Canadian National Teletype network throughout Ontario.

Centre:

Testing and regulating chief guards against "trouble calls" by maintenance routines in the Telex exchange.

Below:

Telex operators have replaced key operators.

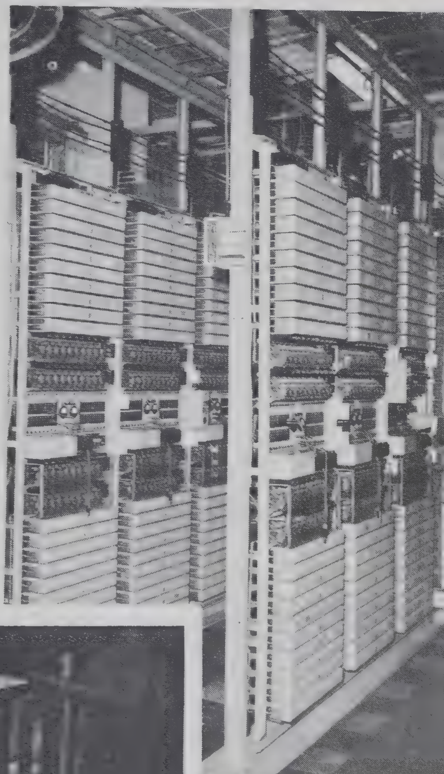


Photo:
Canadian Pacific

Photo:
C.N. Railways

Automatic methods, of which the teleprinter is perhaps the best known, have largely supplanted telegraph key operation. Messages are now sent by typing on the keyboard of a teletype—this is similar to an electrified typewriter—flashed through switching centres and printed on either roll or sheet paper at their destination (either the customer's own premises or the local telegraph office).

The "carrier" is no longer confined to the use of telegraph land lines. Telegraph circuits are often superimposed on telephone wire circuits and extensive use is made of microwave radio relay networks. Using the microwave network, messages are sent between reflectors on microwave towers; intermediate towers serve as unattended relay stations to instantly receive, regenerate and redirect signals to the next tower. Also, an increasing amount of overseas communications, formerly carried by underwater transatlantic cable, are now transmitted by radio.

Among the many items of telegraphic equipment leased from the telegraph companies and installed on the customer's own premises are private wire networks which may include their own switching centres. These networks, for example, supply stockbrokers with market quotations or city newspaper offices with details of the latest events. Facsimile equipment—a method of transmitting and receiving pictures and similar material—are also a common feature in newspaper offices. Contributing to the expanding use of private wire systems is the use of electronic data processing, or office automation. Many business firms now use a combination of telegraph wires and specially-designed office equipment to streamline their operations and transmit payroll, inventory and other statistical data between their many offices across the country.

Nature of Work

There are several groups of related occupations in the industry and, within each group, there are many classifications.

The *testing* and *regulating* group, located in terminal offices in the larger cities and the repeater stations in smaller locations, is responsible for the operation and maintenance of switching and terminating equipment. They keep records, perform routine tests and correct faults on the equipment which permits teleprinter, telex, data transmission and other circuits to be carried from city to city over land line, cable or microwave.

Equipment maintenance personnel usually work individually and visit subscriber's premises where they inspect and maintain customer-type installations such as teleprinters, stock tickers and data transmission machines.

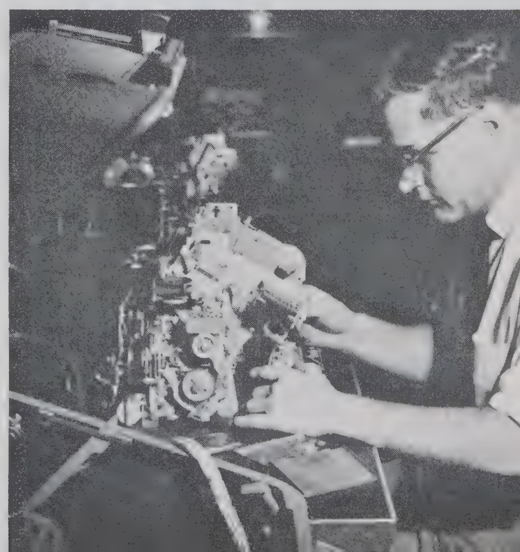
Installation personnel, working to drawings and specifications, install and test the carrier systems and terminating equipment which carry the great variety of communications services. They also install power plants and major units of subscriber equipment.

Microwave technicians are involved in the maintenance, operation and repair of microwave systems. They are usually assigned to terminal or relay stations.

Radio technicians undertake maintenance and repair on end-to-end and base station radio installations and are also concerned with railway hump yard and television systems.

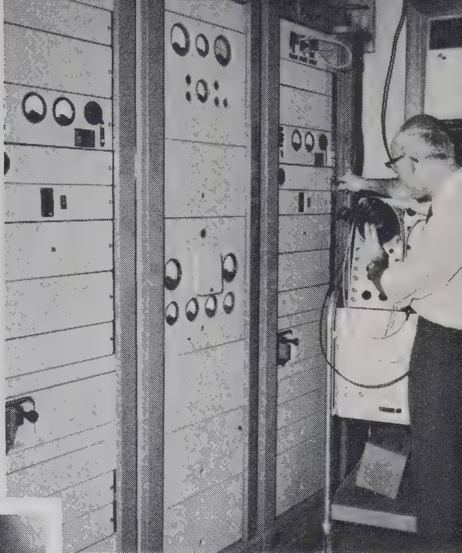
Located in centralised workshops are *instrument mechanics* who repair and adjust various items of equipment and who, on occasion, are involved in the actual construction of highly specialized equipment.

Installing and maintaining the country-wide wires and cables are *construction, linemen* and *cable splicing crews*. Their duties are similar to those previously described in the section dealing with telephone workers.



Changing a set of gears on a teletype machine presents no problem to a well-trained mechanic.

Photo: Canadian Pacific

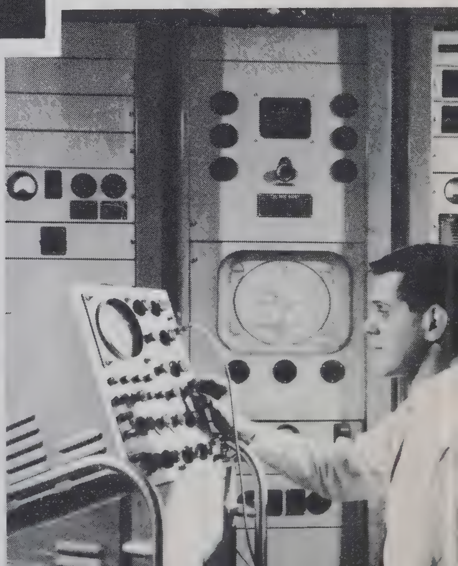


A microwave technician undertakes routine tests using a cathode ray oscilloscope.

Photo: Canadian Pacific

An equipment installer uses a wiring diagram to produce "Bay Form". When units are later mounted in front of the relay rack, hundreds of colour coded wires will appear at "just the right spot".

Photo: Canadian Pacific



A microwave terminal monitor bay.

Photo:
C.N. Telecommunications

Personal Qualities Needed

Modern high standards of service demand that workers of all classifications and levels be highly competent, alert and aggressive in their duties. Because of the many advances being made in the industry, employees should be most concerned with personal self-development; it is possible for a worker who is fully qualified today to become obsolete within a decade if he does not keep his skills and knowledge up to date.

In some types of work dextrous hands are required since both wiring and equipment are becoming "miniaturised". Good health and physique are also desirable.

Many workers require a neat appearance and pleasant disposition because of customer contact.

Preparation and Training

Young men between the ages of 18 and 25 with a minimum of three years high school education are preferred by employers. Courses in electricity, electronics and mathematics such as can be obtained through an institute of technology will increase chances of promotion.

It should be noted that there are many jobs with lower entry educational standards. However, employers who were consulted during the preparation of this booklet, very carefully pointed out the following educational standards they consider necessary to cope with the increasing complexity of the telecommunications field. Those with only minimum standards of education on entry are seriously handicapped and promotion is limited—it is very difficult to improve educational standards when engaged in earning a living. Employers emphasize that potential workers should obtain all the education possible—high school, technical institute or better —if they are to keep pace and advance in the industry. Employees are also encouraged to prepare for promotion by taking home study courses and some financial assistance may be given.

There are no formal apprenticeship schemes; training programs are often provided for specific jobs and consist of a general course in a company-conducted school followed by periods of supervised on-the-job training. Further classroom study and laboratory practice are given as necessary on specialized equipment.

It is expected that company-sponsored and company-conducted methods of training will continue to grow because of the technological advances taking place in the telecommunications field.

Advancement

The telecommunications industry is highly specialized and, for this reason, promotions tend to be filled from within a particular company. To supervise specific areas, work experience in such areas is a prime requisite and the most experienced personnel are usually selected.

Working Conditions

Working conditions, including health and welfare, are similar to those in the telephone industry.

Organizations

Non-supervisory employees are covered by union agreements and represented by affiliates of national or international unions. The Commercial Telegraphers Union represents the majority of employees such as installers, equipment maintainers, testing and regulating personnel, microwave and radio technicians, etc. The Order of Railroad Telegraphers represents outside plant personnel such as linemen and cable splicers.

Employment Outlook

Any growth of the telecommunications industry is directly related to general growth and prosperity of Canada as a whole. This country is becoming increasingly industrialized and has almost unlimited growth potential. The fact that modern industry and business are demanding more communication services and in greater variety indicates that there is ample opportunity for stable employment and advancement for those with a good technical background.

On the other hand, changing techniques are reducing the intake of telegraph operators and clerks. For example, in large offices, both commercial and railway, teletypes have taken over almost all of the work formerly done by a key operator. However, there is still some need for key operators in smaller stations.

RADIO OPERATORS

Radiotelegraphy had its inception in 1901 when Marconi spanned the Atlantic Ocean with a message received in St. John's, Newfoundland and transmitted from Poldu, England. Up to this time communications had been limited by the wires of the telegraph systems; now oceans and continents could be spanned with a new medium which could use the atmosphere as the carrier and appropriately named "wireless".

After Marconi's demonstration, radio was used mainly for maritime telegraphs. Its value was forcibly brought to public attention when, in 1909, the liner "Republic" sank off Nantucket Island. Thanks to a wireless call, all but six of those on board were saved. Today life at sea—and over the air routes—is safeguarded by international regulations requiring, among other things, the employment of certificated radio operators.

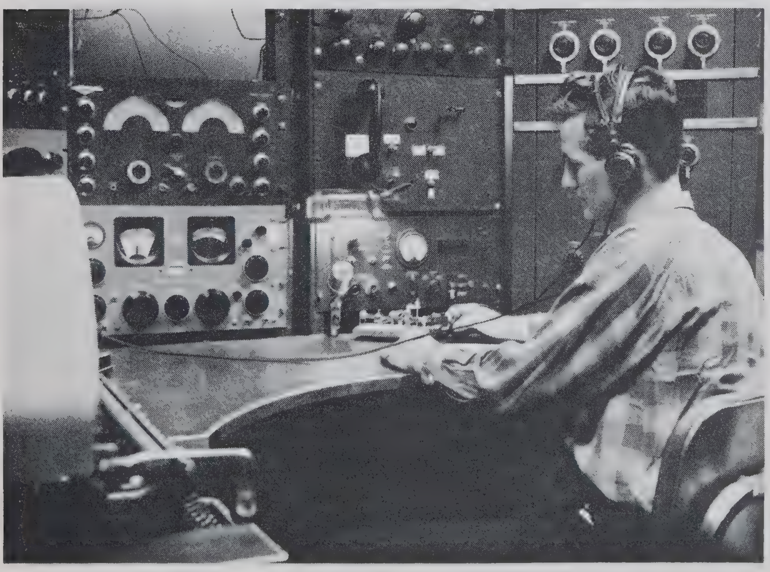


Photo: N.F.B.

Radio operator transmits a message using a semi-automatic key or "bug".

Initially, communication by radio was confined to the emission of code signals; also, very early circuits were not tunable. Sir Oliver Lodge's discovery by which circuits could be tuned, made possible the use of many stations, each with a fixed frequency.

Discovery of the vacuum tube, by Fleming and DeForest, and of the thermionic tube, led to a second method of communication—radiotelephony—by which voice, music or other non-code signals could be sent by "modulated" carrier wave.

Today it is possible to communicate with all parts of the world, and with ships, trains and aircraft. Working as the link between these fixed or mobile communications centres are the *radio operators*.

Field of Work

Before going on to discuss the field of work it is necessary to know that there are two types of operators—certificated and non-certificated—since certification largely determines their field of employment.

The largest single employer of certificated operators is the Department of Transport, followed by the field of civil aviation and the merchant marine.

Four main services are provided by the Department of Transport; they are.—

Marine Service—giving assistance to ships from radio stations located along or in the vicinity of sea lanes. Work in this service may be in isolated areas or, alternatively, in coastal or populated districts. For example, marine stations are maintained in the Hudson's Bay and Baffin Bay regions.

Aviation Service—provides services to aircraft prior to, following, or during flights, from radio stations located at airports or along air routes. Stations are maintained, for example, in Labrador, the Northwest Territories and up to 500 miles from the North Pole and at international airports in or near main cities.

Monitoring Service—ensures that all radio stations operate as authorized, that is, staying on their allocated frequencies, avoiding

interference with other stations and maintaining radio silence at certain intervals. This service is more frequently undertaken in populated areas.

Ionospheric Service—to measure the characteristics of the upper atmosphere and to gather information for advance weather forecasting. These stations are located in many types of districts but are often in isolated areas.

In *civil aviation* radio operators are employed by the airlines on ground stations, ranging from main air terminals to small, isolated airstrips. In Canada, they are no longer employed in aircraft as the radio equipment is controlled by a pilot with a Radiotelephone Operator's Restricted Certificate. At smaller airports, the radio operator may also act as the dispatcher or agent.

Merchant marine operators may be on ships which, by law, are required to carry radio installations for safety purposes or ships which handle public correspondence. This work is on sea-going vessels since the majority of inland and coastal vessels are equipped with radiotelephone systems only and do not, as a rule, carry certificated operators.

For the non-certificated operators, the field of work is on land stations, usually in towns and cities. They are employed by the *railways* for communications between various stations; by *provincial governments* for police, fire and other emergency services; by *municipal authorities* for police and fire prevention work; and on private stations operated by *mining companies, taxi companies, utility companies* and by *commercial broadcasting stations*. It may be mentioned that some broadcasting stations prefer to hire certificated operators. (Operators in broadcasting are dealt with under the heading Broadcasting—Sound and Television.)

Nature of Work

The radio operator is responsible for the maintenance of communications contact between fixed or mobile ground stations, or with ships, trains and aircraft. To fulfil this responsibility, his duties are many and varied and depend, to a large extent, on his field of work. They may include any or all of the following.—

(i) Transmitting and receiving messages either in Morse Code using a telegraph key, by teletype machine or by radiotelephone.

(ii) Monitoring radio aids to navigation such as Instrument Landing Aids, Visual Omni Range, etc., and maintaining watches at prescribed intervals.

(iii) Taking weather observations and translating them into weather codes, or sending weather information.

(iv) Keeping watch and maintaining station records using a fixed procedure.

(v) Repairing and maintaining equipment—inspection, testing, trouble shooting and adjustment of equipment.

As previously mentioned, the duties will vary with the type of station—they will also vary with the size of the station. On larger stations, where there are more staff, there is a greater degree of specialization; with a smaller station, a single operator may be required to perform all functions of the particular station.

Personal Qualities Needed

Among the more important qualities needed for success in this field of work are.—

A sense of *responsibility* and *accuracy*—it is of vital importance, particularly in maritime, aircraft and emergency communications, that messages are sent or received accurately and quickly.

Self-reliance and *confidence*—operators may have to make important decisions, especially aboard ship or on smaller stations.

Good hearing—the Department of Transport requires at least 75 per cent of normal hearing as a pre-certificate requirement—and a *clear speaking voice* is necessary.

In addition, those who may work in isolated areas, or aboard ship, must be in good physical condition and have the ability to get along with people.

Preparation and Training

Employers usually require that applicants be in possession of a radio operator's certificate before hiring. The Department of Transport is not only an employer of radio operators but is also responsible for the examination and licensing of all such operators while employed in Canada or on ships of Canadian registry. The Department issues a bulletin titled "Syllabus of Examination" giving details of certification. It sets forth the conditions and requirements for certification under the following headings: persons eligible to attend examinations; knowledge required; suggested textbooks and diagrams; procedures of application for examination; and the skill and knowledge requirements for certificates of proficiency. It also lists ten approved radio training schools as well as 27 departmental offices across Canada at which examinations are conducted.

Before commencing the somewhat lengthy period of training, a copy of this Syllabus should be obtained from the Director, Department of Transport, Telecommunications Branch, Ottawa.

Training may be obtained by day, evening and correspondence courses offered by a small number of private schools and in some provincial or technical schools. The length of the course depends on the individual's ability to absorb the tuition and the time to reach the sending speeds for a particular certificate but private trade schools stipulate a minimum of eight to nine months.

A minimum of two years high or technical school with emphasis on mathematics and physics provides valuable preparation for the would-be operator however, most employers prefer high-school graduation. Technical courses in electrical and radio theory and practices are especially useful.

Listed below are some of the schools licensed to operate equipment in connection with the courses they offer. However, graduates from these, or from any other training school, are required to pass the full Department of Transport examinations before being awarded a Certificate of Proficiency, regardless of any diploma they may have been awarded by their school.

Radio Electronics Centre, 12th Ave., 8 Oak St., Vancouver, B.C.

Southern Alberta Institute of Technology, Calgary, Alberta.

Technical High School, Corner of Ross St. and First Ave., N.E., Moose Jaw, Sask.

Manitoba Technical Institute, Portage Ave., at Wall St., Winnipeg 10, Man.

Radio College of Canada, 86 Bathurst St., Toronto 2B, Ont.

Central Technical School, Lippincott and Harbord Sts., Toronto 4, Ont.

Radio College of Canada Ltd., 3454 St. Denis, Montreal, Que.

Marine School of Rimouski, 22 St. Louis St., Rimouski, Que.

Saint John Vocational School, Douglas Ave., Saint John, N.B.

Vocational Training Institute, St. John's, Nfld.

Advancement

Radio operators in the Department of Transport advance on the basis of further experience and training to higher grades of operator and to supervisory positions or they may write departmental examinations leading to positions as technicians, inspectors and technical officers. Those in other fields often take additional technical training which, in turn, leads to technical or supervisory work within their own company.

Working Conditions

Working conditions, in general, are similar to those found in office occupations. Duties are not physically strenuous; however, operators on isolated stations may be subject to cold and wet conditions when taking outdoor meteorological readings and are required to handle station supplies—fuel drums, water and equipment—as supplementary duties.

In the Department of Transport, operators are required to serve tours of duty on isolated stations; this is compensated for, to a degree, by isolation allowances.

Operators on small units and mobile stations may find such conditions as accommodation, sleeping quarters, working hours and meals less favourable than those on fixed or larger stations.

On stations which provide a 24-hour, 7-day week service, operators rotate through the three shifts—day, evening and night. This prevents a fixed or exact number of hours per week but an average of 40 hours per week is usual. Certain limits are placed on the number of consecutive hours worked in any 24-hour period and the number of hours worked in any 28-day period.

Organizations

Radio operators are covered by affiliates of international unions such as the Order of Railroad Telegraphers and The Commercial Telegraphers Union.

Employment Outlook

Because of the rapid advances being made in voice communication systems, including improvements in high-frequency range, opportunities for key operators are diminishing.

In the future it is expected that most messages will be sent by voice. This probably will lead to division of duties, i.e., "communicators" will transmit voice messages only and maintenance or repair of equipment will be undertaken by electronic technicians.

BROADCASTING—SOUND AND TELEVISION

Radio broadcasting, originally used in the 1900's as a means of ship-to-shore communication, developed during the 1920's into an exciting novelty which glued people to the earphones of their crystal sets.

During the pioneer stages the important aspects of broadcasting —educational and cultural possibilities and potential advertising profits—were not realized and equipment manufacturers were at the forefront in station operation, primarily as a means of selling their sets.

Not until the mid-thirties and forties was radio fully exploited as an instrument of education and entertainment for the listeners and of profit to the broadcasters. This era, which saw the founding of the Canadian Broadcasting Corporation in 1936, was one of consolidation and expansion and the present pattern of development and control was firmly planted. On the tenth anniversary of the founding of the CBC, radio coverage was available to 90 per cent of the population.

Television broadcasting was introduced at mid-century when Canada joined other nations in the fascinating experiment of projecting the visual image along with the spoken word.

The Board of Broadcast Governors, created in 1958, and responsible to Parliament, is the regulating and controlling authority over all broadcasting in Canada. There is a publicly owned system of broadcasting—the Canadian Broadcasting Corporation—operating 29 radio and 14 television outlets, and a system of privately owned stations with 202 radio and 57 television stations. The CBC operates three radio networks—one French and two English—comprising all of their stations and 101 of those privately owned, with most of the national programs originating from five main production centres; Vancouver, Winnipeg, Montreal, Toronto and Halifax. Programs are also planned regionally as, for example, the local and national farm coverage. In addition, the CBC operates two television networks—one in each official Canadian language—and an International Service transmitting overseas in 16 languages. Similar extensive coverage is also provided by the privately owned, nation-wide television network and regional radio networks.

In Canada, broadcasting has been complicated by a sparse population with a not-inexhaustible supply of advertising revenue, living along a 4,000 mile strip which extends over seven time zones, and a historic bi-cultural division. Nevertheless, radio is now available to over 98 per cent of the population and television to more than 92 per cent.

Overcoming these difficulties has been, and will continue to be, a challenge to the skills and ingenuity of the regulating authorities, the planners and the engineering and other technical workers. Co-operation by other industries has played no small part in country-wide coverage. The Trans-Canada radio network, built by the telephone and telegraph companies and carrying two television programs, is one example of this co-operation. Technological advances include the installation of low-power transmitters connected to wire lines which link the radio network stations; in television, a parallel development has resulted in the establishment of rebroadcasting stations. Television is still new and development continues to take place, as for example, the recently introduced video tape method of broadcasting and rebroadcasting with little or no loss in original quality.

Maintaining the broadcast services of entertainment, information and cultural activities requires many different types of skill—artistic, sales, administration and technical. Details of the technical occupations are given in the following paragraphs; other skills, such as artistic and sales, will be dealt with in other monographs which form part of this series.

Field of Work

Broadcasting stations offer a variety of interesting jobs in communities all over the country. Generally the most specialized jobs—and the best paying—are concentrated in the nation-wide networks and large stations which produce the more elaborate and expensive shows. However, opportunities to enter broadcasting are better in the smaller communities and the smaller stations. Practically all of the larger stations are located in main cities but small stations are found in large cities as well as in small communities.

Radio stations usually have much smaller staffs than television stations but the staff of individual stations varies greatly.

Nature of Work

The technical or engineering department of a broadcast station is responsible for converting the sounds and pictures which make up a program into electronic impulses that can be received on home radio and television sets. Placing microphones, adjusting levels of sound, keeping transmitters operating properly, moving and adjusting microphones and cameras and the lighting of television scenes and performances are the main duties of the technical staff. They also install, operate, maintain and repair the many types of electrical and electronic equipment used in these operations.

There are three main groups of technical workers in both sound and television broadcasting—operating technicians, maintenance technicians and engineers—the first group being the most important from the point of view of numbers employed. It must also be borne in mind when reading of these occupations that the titles "operator", "technician" and "engineer" may be used interchangeably at various stations.

Since the occupational titles used are related to an area of work, it is first necessary to explain briefly how a program is originated and transmitted.

Programs originate in a broadcast studio which has an adjacent control room. Special events, such as sports and items of news of national interest, may originate in the "field" at a point remote from the studio and be relayed to the station either by a mobile transmitter or by land line, or be recorded on tape for later use or sale. Television programs may also include the projection of motion-picture films, slides and opaques.

Sound broadcasting station studio control room.

Photo: N.F.B.

All programs, whether originated in the studio, in the "field" or from film, are fed to a master control and then through the station transmitted for reception by the home receiver. In the case of a network originating station, the program will also be fed via the master control to other stations in the network by land lines, or microwave system.

Sound Broadcasting—Operation

Small stations generally use their personnel in "combination" jobs with duties which cross the line of other departments found in large companies. It is worth keeping in mind that "combination" jobs offer new workers an opportunity to learn all the different phases of broadcasting. On larger stations, where work is more specialized, at each stage in the broadcast process the following distinct workers may be found in jobs with varying degrees of skill and knowledge.

Responsible for the setting up and operation of all equipment in the studio is the *studio technician* whose primary duty is to monitor programs during rehearsal and transmission and advise the producer on technical matters; all studio control room equipment is the responsibility of this technician who, during a broadcast, blends or "mixes" the output of the individual microphones by volume controls, observes the overall effects on a monitor and thus maintains the level and quality of transmission.

Portable equipment such as microphones, amplifiers and short-wave transmitters to bring special events from the "field" is set up, tested and operated by the *field* or *outside broadcast operator.*

One of the senior workers, the *master control-room technician*, prepares, sets up and tests apparatus in the master control room. He maintains contact with, and monitors, all feed sources to maintain technical quality and to substitute programs in the event of breakdown in the scheduled program.

A *transmitter technician* operates and maintains the transmitter, which may be located apart from the station, and other equipment including aerial systems, and monitors transmissions to detect faults or to prevent them from developing. Transmitters may be designed to operate unattended, in which case the technician may make periodic checks only.

Photo: N.F.B.

Recording technicians.

Preparation, setting up and the operation of recording discs, tapes and other reproducing equipment for broadcasts, auditions and station use are the jobs of the *recording-room technician*.

Often on smaller stations, a *general technician* undertakes several of the previously-mentioned functions—he may even be called on to undertake on-the-spot announcing or be employed as an *announcer-operator*.

Sound Broadcasting—Maintenance and Development

Maintenance in larger stations is the work of full-time *maintenance technicians* who have usually advanced from operator positions; smaller stations combine the work of maintenance with that of operating. This work involves the servicing and repair of electrical, electronic and mechanical equipment and the construction of small units such as filters and amplifiers. Hand and power tools are used together with test equipment such as oscillators, meters and oscilloscopes.

A small number of *technicians* are employed in the Transmission and Development Departments of the large networks and by the network suppliers in the development of new electronic apparatus to meet special problems on a station or in the industry. This field requires a high degree of skill and experience since the work may vary from the drafting of a complicated circuit to the making of a prototype installation.

Operating technicians have a function, as in radio broadcasting, at each stage in the television process and, although often experienced in many phases, usually specialize in one particular activity. However, with the addition of sight to sound, television is more complicated than radio with the result that more people are needed to operate a television station.

Television programs originate from a studio which is similar to a theatre stage setting but with the addition of cameras and microphones plus extra lighting; from mobile units in the "field" for special events; or from the running of pre-recorded material such as motion-picture films or magnetic tapes. In most cases, the program is passed through the master control or transmitter booth where it is co-ordinated before being fed to the transmitters; this also applies to studio-originated programs even though they have to pass through the studio control room.

On the sound or "audio" side, the nature of the work is similar to that described for radio; on the sight or "video" side, further techniques are involved. Video equipment is more complicated than sound. Picture signals are sent on one frequency and the accompanying sound signals are sent simultaneously on a different but adjacent frequency to very close tolerances; not only are video and sound signals transmitted but synchronizing signals are also sent so that the home receivers can reconstitute the picture in the correct sequence.

Video signals in the studio or in the field are produced by electronic cameras, mounted on wheeled carriers known as "dollies", and operated by a *video camera operator*. He, following the action with the camera and observing the scene through the camera viewer, moves or instructs assistants to move the camera, alters the distance and angle of the shooting and makes any necessary lens adjustment. From the cameras the scenes are fed by flexible cable to the studio control room before passing to the master control.

Sound is picked up by microphones which may be suspended on rods known as "booms"; this boom installation is set up and controlled by a *microphone boom operator* who adjusts the positions of the various microphones by remote control.

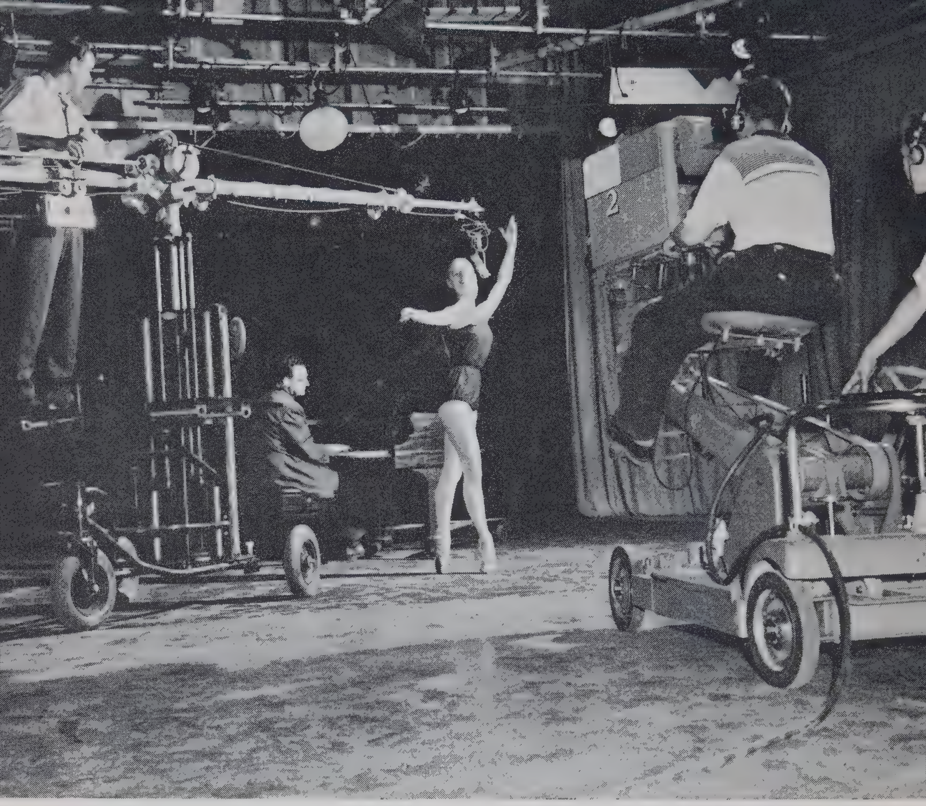


Photo: N.F.B.

Microphone boom and camera technicians.

In the studio control room there are two types of technician; video and audio. The *video control technician*, working in conjunction with the camera operator, is responsible for the electrical control, adjustment and transmission of picture signals. He operates equipment to control picture detail, shading, synchronization of signals and adjustment of picture level. The *studio audio technician* has similar duties to those described for his counterpart in sound broadcasting; in addition he may direct the boom operator. A *switching technician*, under the direction of the technical producer, operates switching/mixing equipment to mix, dissolve and change the output of one or more cameras and allow the desired signal to pass to the master control. On large productions, a *lighting control technician* may direct the lighting control board technicians through an inter-communication system from the studio control room.

As previously explained, programs are passed through a master control room. The *master control-room technician* checks the quality and level of all incoming signals, adjusts and operates microwave equipment, performs switching operations in accordance with station procedures and, in general, performs similar duties to those of the master control-room operators in sound broadcasting. Also, he is usually responsible for complete system checks and tests.

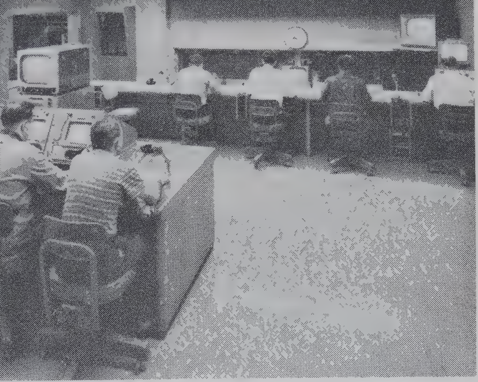
In the televising of motion-picture films, the film is passed through a projector and the image picked up on an electronic camera; video signals from the camera are relayed from the projection room through a camera-controls technician position and then to the master control for outward transmission or to a studio where the film pick-up may be inserted in the studio output as required. Operating the sound and still (slide) equipment is a *projection room operator* (projectionist).

Other workers may include lighting technicians who prepare, set up and operate the lighting control equipment for studio, film and outside broadcasts and who may be required to have an electrician's licence; sound effects technicians employed by the larger companies in both radio and television, to plan, devise, operate and record manual and electronic sound effects; and boom operators and cablemen.

In the less specialized stations, and depending on the amount of original programming, several of the specialist jobs may be combined and undertaken by a *general television operator* or technician.

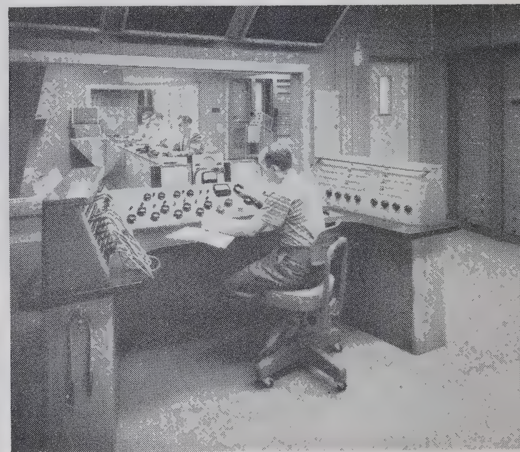
In combined studio transmitter stations, *audio technicians, video control technicians* and *switcher technicians*, seated at a control panel in a transmitting booth, have essentially the same functions as the corresponding staff in the studio control room. Since television is more complicated than sound broadcasting, a *transmitter technician* is usually employed to maintain and operate the transmitting equipment of the station.

Maintenance work, and also development, is similar to that of the sound stations. The *maintenance technician* has usually obtained a complete knowledge of operating techniques before going on to maintenance work. He repairs and services equipment, conducts performance tests and occasionally carries out operating



Vision and production control positions in a CBC studio.

Photo: Herb Nott, Toronto



Audio control position in the CBC No. 7 studio.

Photo: Herb Nott, Toronto

Television station master control room.

Photo: CJOH (Ottawa-Hull) — CTV

functions. On the development side, technicians working in conjunction with an engineer, undertake or assist in installation or modification of equipment and systems. Development may be part of the maintenance technician's duties or, in larger stations, development is a full-time position.

Personal Qualities Needed

Certain personal qualities are common to most technical occupations—ability to work under pressure (of prime importance), dependability, resourcefulness, good judgment, artistic sense (especially for studio operation) and a liking for people since teamwork and co-operation is essential.

Preparation and Training

Both inexperienced workers (18 to 22 years) and older workers (20 to 45 years) with related experience are hired by sound and television stations and prepared for skilled work by a combination of on-the-job training and classroom study.

Minimum education on entry depends on the standards set by the station. That set by the CBC for their operators and technicians is junior matriculation plus one year of high school technical training up to, and including, graduation from an accredited radio and television school or institute. Standards of education in privately owned stations vary, being similar to the CBC on smaller stations with the larger stations preferring additional training and experience. For advancement to higher positions, it is advantageous to have graduated from a technical institute in the theory of electricity and electronics and possibly acoustics or optics.

New entrants, as well as all station employees, are encouraged to improve their education by home study in technical subjects. Correspondence courses are the more common because of irregular working hours. The CBC has a formal training program with training staff to assist employees with home study courses and small classrooms where selected groups are given lectures and practical laboratory sessions.

Most of the privately owned stations are members of the Canadian Association of Broadcasters; this employer organization sponsors courses in institutes of technology for their employees.

The entry occupation is that of learner or trainee who helps the qualified worker while taking theoretical and practical training. After a period as a trainee, and depending on ability, the trainee advances to the job of an assistant. Some learners in television may be selected from sound broadcasting; others come directly from radio and television schools. On completion of assistant training, the employee reaches full status as an operator. From entry as a trainee to the position of operator will take from one to four years, depending on individual progress.

Advancement

The path of advancement for operators is either to maintenance or to senior technician and supervisory positions in their respective fields.

Many companies have a policy that those on the maintenance staff must first become proficient in operating so they will be aware of problems which may confront the operator.

Advancement is gained by internal promotion or by moving to other stations.

Senior technicians may advance to technical producer provided that they have artistic and creative ability in addition to a technical background; administrative ability is also required since a producer must organize and be responsible for the team which produces and broadcasts the program.

Working Conditions

Work in radio and television stations is usually indoors in well-lighted and air-conditioned buildings. Special event programs are originated under varying conditions and technicians may be exposed to wet and cold weather.

Certain hazards exist such as electrical shocks and burns since the work, particularly in maintenance, involves high voltages; safety practices and equipment, however, are designed to keep these hazards to a minimum. Those on transmitting may be required to work at heights on aerial systems and in cold and wet weather, particularly where the transmitter is remote from the station.

Irregular hours are common in both television and sound for operating staff. Radio broadcasting is on a 24-hour, 7-day week basis requiring shift work, either day, evening or nights plus weekends and holidays. Maintenance technicians may have a more regular working schedule except in the event of breakdowns.

Organizations

Technical personnel are covered by national or international union organizations. Two of the larger unions are the National Association of Broadcast Employees and Technicians and the International Brotherhood of Electrical Workers.

Employment Outlook

In both sound and television broadcasting the employment outlook hinges on certain factors. Foremost of these being the opening of new television stations and extension of existing radio stations. There is a tendency towards an increase in the number of hours of television broadcasting from those existing. In 1959, the English language television network broadcasted for 59 hours per week and the French language network 70 hours. The policy towards increasing the amount of Canadian-originated programs and the advent of colour television will also have an effect.

On the other hand, technological advances such as magnetic tape recording and improvements in equipment such as unattended transmitters will have an adverse effect on employment.

With the foregoing factors in mind, it is expected that the broadcast industry will continue to grow at a fairly steady pace in the foreseeable future.

SEEKING EMPLOYMENT

Students leaving school to find their first job may apply to the local offices of the National Employment Service, where they will be given every assistance in locating a suitable training situation. Students graduating from secondary schools may obtain assistance from the school placement officer. In provinces where a trade is designated for apprenticeship, local apprentice authorities are in a position to advise applicants regarding training opportunities.

Any of the three Services of the Armed Forces offer good opportunities in the electrical and associated fields.

Vacancies both for new entrants and for those seeking to change jobs are often advertised in the daily newspapers. Government vacancies are advertised in the press and by posters in public buildings and are filled by open competition; these vacancies normally require five years residence in Canada and may also, in certain instances, be limited to residents of a particular province.

Job seekers may also apply directly to likely employers without reference to a particular vacancy and employment leads can be obtained from friends and relations already working in the industry. Application should be made as early as possible since such firms generally have a waiting list.

Those intent on becoming well-qualified should select firms known to have good training programs. These firms are selective about taking on apprentices, preferring those with good educational background or vocational and technical school training and may make it a practice to give preference to applicants who are recommended by their own employees; it may be valuable, therefore, to have friends already in the trade.

EARNINGS

Due to the different methods of reporting pay scales, the figures given in the following Tables are approximate only and are included for general guidance. Pay scales frequently change, are subject to geographical differences and vary with the degree of responsibility. The reader should refer to the National Employment Service, local employers, union officials, newspaper advertisements, and government publications such as Wages Rates, Salaries and Hours of Labour in Canada, Department of Labour, Canada, for current rates in a particular area or company.

TABLE 1 — ELECTRICIANS

October 1960

Locality	CONSTRUCTION (Building and Structures Only) Hourly Rate	MAINTENANCE (All Industries) Average	Predominant Range
	$	$	$
St. John's Nfld.	2.15	1.97	1.63 – 2.05
Halifax, N.S.	2.27	1.96	1.74 – 2.05
Sydney, N.S.	2.15	2.15	1.55 – 2.80
Moncton, N.B.	2.00	2.06	–
Saint John, N.B.	2.00	1.88	1.76 – 2.10
Drummondville, P.Q.	1.75	1.55	1.44 – 1.67
Montreal, P.Q.	2.45	2.13	1.89 – 2.45
Quebec, P.Q.	2.05	1.99	1.69 – 2.49
London, Ont.	2.85	2.31	2.00 – 2.59
Ottawa, Ont.	2.52	2.38	1.99 – 2.59
Sault Ste. Marie, Ont.	2.25	2.79	2.59 – 2.86
Toronto, Ont.	3.40	2.28	1.95 – 2.60
Winnipeg, Man.	2.75	2.18	2.05 – 2.46
Regina, Sask.	2.34	2.35	2.10 – 2.60
Saskatoon, Sask.	2.46	2.25	1.90 – 2.51
Calgary, Alta.	2.85	2.47	2.05 – 2.80
Edmonton, Alta.	2.85	2.28	2.05 – 2.64
Vancouver, B.C.	3.26	2.51	2.05 – 3.09
Victoria, B.C.	3.00	2.78	2.45 – 2.97

SHIPBUILDING AND REPAIRING

	Hourly Rate Average	Predominate Range
	$	$
Canada	2.03	–
Nova Scotia	1.87	1.83 – 1.88
Quebec	1.92	1.86 – 1.98
Ontario	1.94	1.90 – 2.06
British Columbia	2.60	–
AIRCRAFT (Manufacturing)		
Canada	2.06	–
Quebec	2.05	1.89 – 2.14
Ontario	2.14	2.01 – 2.36
Manitoba	1.98	1.80 – 2.16
MINING (All Types)		
Canada	1.64 – 2.64 (range of average rates)	
(rates vary with type of mine and geographical location)		
RAILWAY (Locomotive and Car Shops)		
Canada	2.05	–
ELECTRIC LIGHT AND POWER		
Canada	2.46	–
Newfoundland	2.41	–
Nova Scotia	2.06	1.83 – 2.75
Quebec	2.10	1.80 – 2.39
Ontario	2.55	2.44 – 2.59
Manitoba	2.34	2.22 – 2.42
Saskatchewan	2.44	2.38 – 2.43
Alberta	2.74	2.64 – 2.80
British Columbia	2.84	2.66 – 2.97

TABLE 2 — POWER GENERATION AND DISTRIBUTION WORKERS

October 1960

Occupation and Locality	Hourly Rate Average $	Hourly Rate Predominant Range $
GENERATION		
Operators (75,000 k.w. and above)		
Canada	2.56	–
Quebec	2.28	1.94 – 2.47
Ontario	2.89	2.47 – 3.20
Manitoba	2.35	2.37 – 2.53
Saskatchewan	2.57	2.22 – 3.12
British Columbia	2.84	2.66 – 3.06
Operators (1,000 to 75,000 k.w.)		
Canada	2.22	–
Newfoundland	1.59	1.34 – 1.83
Quebec	1.85	1.55 – 2.28
Ontario	2.50	2.27 – 2.79
British Columbia	2.90	2.79 – 3.06
Switchboard Operators (Power House)		
Canada	2.33	–
Nova Scotia	2.25	2.04 – 2.87
Quebec	2.11	1.99 – 2.32
Ontario	2.79	2.62 – 3.04
Saskatchewan	2.41	2.33 – 2.43
Floormen (Wheelmen)		
Canada	2.06	–
Nova Scotia	1.79	1.28 – 2.62
Quebec	1.87	1.75 – 2.00
Ontario	2.38	2.21 – 2.58
Manitoba	1.96	1.68 – 2.13
Saskatchewan	2.02	–
British Columbia	2.27	2.06 – 2.38
TRANSMISSION AND DISTRIBUTION		
Substation Operators		
Canada	2.42	–
Nova Scotia	1.62	1.40 – 1.85
Quebec	2.19	1.98 – 2.34
Ontario	2.61	2.27 – 3.00
Manitoba	2.39	2.22 – 2.50
Alberta	2.81	2.75 – 2.87
British Columbia	2.78	2.37 – 3.06
Linemen		
Canada	2.34	–
Newfoundland	1.67	1.45 – 2.08
Nova Scotia	1.91	1.58 – 2.20
New Brunswick	1.89	1.82 – 2.25
Quebec	1.99	1.75 – 2.18
Ontario	2.49	2.40 – 2.59
Manitoba	2.51	2.33 – 2.66
Saskatchewan	2.63	2.57 – 2.68
Alberta	2.62	2.39 – 2.86
British Columbia	2.99	2.77 – 3.11
Meter Repairmen		
Canada	2.34	–
Nova Scotia	1.95	1.74 – 2.07
Quebec	1.96	1.75 – 2.11
Ontario	2.38	2.20 – 2.57
Manitoba	2.10	1.94 – 2.40
Alberta	2.40	2.10 – 2.78
British Columbia	2.86	2.84 – 2.90

TABLE 3 — TELECOMMUNICATIONS WORKERS

Selected Occupations in Telephones
October 1960

Occupation	Weekly Rate: Canada Average $	Weekly Rate: Average Range $
Central Office Group		
Central Office Repairmen	92.00	62.00 – 115.00
Linemen Group		
Linemen	79.00	61.00 – 112.00
Cablemen	90.00	61.00 – 114.00
Station and PBX Group		
Telephone Installers (station installers)	83.00	63.00 – 113.00
Telephone Repairmen (station repairmen)	83.00	58.00 – 101.00
PBX Installers	99.00	63.00 – 115.00
PBX Repairmen	97.00	63.00 – 115.00

Selected Occupations in Telegraphs (Telecommunications)
October 1960

Occupation	Monthly Salary Range $
Testing and Regulating	
Chiefs	400.00 – 455.00
Attendants	380.00 – 425.00
Equipment Maintainers	310.00 – 385.00
Installers	350.00 – 365.00
Microwave Technicians	375.00 – 440.00
Radio Technicians	370.00 – 425.00
Instrument Mechanics	345.00 – 365.00
Cable Splicers	355.00 – 375.00
Linemen	335.00 – 365.00

Radio Operators
October 1960

Occupation	Yearly Salary Range $
Department of Transport	
Radio Operators 1	3,750 to 4,200
Radio Operators 2	4,260 to 4,800
Radio Operators 3	4,620 to 5,160

Note: Extra duty pay or isolation allowances not included in above rates.

Broadcasting — Sound and Television
(Selected Occupations in Quebec and Ontario)
October 1961

Occupation	Weekly Rate: Quebec Average $	Weekly Rate: Quebec Predominant Range $	Weekly Rate: Ontario Average $	Weekly Rate: Ontario Predominant Range $
General Operators[1]	84.00	48.00–114.00	81.00	50.00–121.00
TV Technicians[2]	89.00	73.00–106.00	92.00	73.00–106.00

[1]General Operators (Technicians)—includes studio, field or outside broadcast, master control, transmitter, recording room and maintenance technicians in sound broadcasting.

[2]TV Technicians — includes camera, microphone boom, studio video, studio audio, switching, master control room, projection room, studio transmitter station, transmitter and maintenance technicians in television broadcasting.

Acknowledgments

The co-operation and technical advice of the following organizations, companies and government departments is gratefully acknowledged. Acknowledgment is also made to the many individuals who assisted in the preparation of this booklet and to the numerous publications used for reference.

Canadian Association of Broadcasters

Canadian Broadcasting Corporation

Canadian Electrical Association

Canadian Electrical Manufacturers Association

Canadian General Electric Company Ltd.

Canadian National Telecommunications

Canadian Pacific Railway Company

Canadian Westinghouse Company Ltd.

Department of Transport

Gatineau Power Company

International Brotherhood of Electrical Workers

National Association of Broadcast Employees and Technicians

National Union of Public Service Employees

Philips Electronics Industries Ltd.

The Bell Telephone Company of Canada

The Canadian Manufacturers Association

The Hydro Electric Power Commission of Ontario

The Order of Railroad Telegraphers

Unemployment Insurance Commission

Vocational Training Branch — Department of Labour

CANADIAN OCCUPATIONS FILMSTRIPS

The Department of Labour has prepared, to date, the following occupational filmstrips in collaboration with the National Film Board. A manual has been prepared as an accompaniment to each filmstrip. These may be purchased from the National Film Board, Box 6100, Montreal, or from any one of its regional offices. Prices in Canada: Black and white, $2.00; colour, $4.00.

Plumber, Pipefitter and Steamfitter

Careers in Engineering (revised in colour)

The Social Worker

* Electrical and Electronic Occupations
(revised in colour)

Bricklayer and Stone-Mason

Printing Trades

Careers in Natural Science (revised in colour)

Careers in Home Economics

Motor Vehicle Mechanic

Mining Occupations

Draughtsman

Careers in Construction

Machine Shop Occupations

Sheet-Metal Worker

Careers in Meteorology

Medical Laboratory Technologist (in colour)

Teacher (in colour)

Office Occupations (in colour)

*A visual presentation of the essential facts in this monograph.

Electrical and Electronic Occupations

Monograph No. 16

CANADIAN OCCUPATIONS

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FORGE SHOP OCCUPATIONS

MONOGRAPH 17

REVISED 1959

DEPARTMENT OF LABOUR, CANADA

CANADIAN OCCUPATIONS MONOGRAPHS

(1) Carpenter
(2) Bricklayers and Stone-Masons
(3) Plasterer
(4) Painter
(5) Plumber, Pipe Fitter and Steam Fitter
(6) Sheet-Metal Worker
(7) Electrician
(8) Machinist and Machine Operators (Metal)
(9) Printing Trades
(10) Motor Vehicle Mechanic
(11) Optometrist
(12) Social Worker
(13) Lawyer
(14) Mining Occupations
(15) Foundry Workers
(16) Technical Occupations in Radio and Electronics
(17) Forge Shop Occupations
(18) Tool and Die Maker
(19) Railway Careers

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(24) Geologist
(25) Physicist
(26) Aeronautical Engineer
(27) —
(28) Chemical Engineer
(29) Civil Engineer
(30) Electrical Engineer
(31) Forest Engineer and Forest Scientist
(32) Mechanical Engineer
(33) Metallurgical Engineer
(34) Mining Engineer
(35) Petroleum Engineer

(36) Hospital Workers (other than Professional)
(37) Draughtsman
(38) Welder
(39) Careers in Home Economics
(40) Occupations in the Aircraft Manufacturing Industry
(41) Careers in Construction
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(44) Teacher
(45) Physical and Occupational Therapist

All monographs in the CANADIAN OCCUPATIONS series are priced at 10 cents per copy, with the exception of *Careers in Natural Science and Engineering*, which is 25 cents. A discount of 25 per cent is allowed on quantities of 100 or more of the same title.

Send remittance by cheque or money order, made payable to the Receiver General of Canada to:

The Queen's Printer,

Ottawa, Canada.

CANADIAN OCCUPATIONS

FORGE SHOP OCCUPATIONS

MONOGRAPH 17
REVISED 1959

HON. MICHAEL STARR, MINISTER
A. H. BROWN, DEPUTY MINISTER

DEPARTMENT OF LABOUR, CANADA

FOREWORD

During recent years there has been a steadily increasing demand for Canadian occupational information. The demand comes from youth faced with the need of choosing an occupation and preparing for it; from parents, teachers and vocational guidance counsellors; from workers wishing to change their occupations; from employment service officers; from personnel directors and union officials, and from other quarters.

The CANADIAN OCCUPATIONS series of monographs is designed to help meet this demand. Each booklet describes, among other things, the nature of the occupation or groups of occupations, entrance and training requirements, working conditions and employment outlook.

Occupational information tends to become dated as a result of changes in economic conditions, in industrial technology and in wage and salary structure. Revision of outdated publications is a regular feature of this series, and space is left in the last few pages of each monograph in which to note changes and other local information concerning the occupation.

This series has been prepared with the generous assistance of representatives of management, trade unions and professional associations. The co-operation of the Unemployment Insurance Commission, the Vocational Training Branch of the Department of Labour, and the Dominion Bureau of Statistics is gratefully acknowledged.

This monograph was revised by H. Stuart Fisher under the direction of William Allison, Chief of the Occupational Analysis Section. Grateful acknowledgement is extended to the Dominion Bridge Company, Montreal, and the Steel Company of Canada, Gananoque Works, for their help and co-operation in supplying information.

DIRECTOR,
Economics and Research Branch,
Department of Labour.

January 1959.

FORGE SHOP OCCUPATIONS

HISTORY and IMPORTANCE

Ever since he discovered metals, man has wrestled with the problems of working and using them. To realize how successful he has been in coping with these problems, we need only take note of the important part metal plays in the world today. Many of the things we use daily, such as automobiles, electrical appliances, tools and other pieces of equipment, are constructed of shaped metal parts. Furthermore, most of the non-metal items we require, including much of our food, clothes, housing, etc., are manufactured or processed with machines that are made of metal. In shaping metal stock into these useful articles, modern industry makes use of a number of processes that have been developed down through the ages — processes such as casting, forging, grinding, machining and stamping. One of the oldest of these is the forging process.

Basically the same today as it was in ancient times, the forging process consists in heating a piece of metal stock to a high temperature in a forge and, while it is still hot and malleable, shaping it on an anvil under the forceful blow of a hammer. The major advantage of this method lies in the fact that the natural grain of the metal is retained and caused to flow into the desired shape. This results in the finished product having a greater degree of strength than it is possible to obtain using the other metal-shaping processes. Consequently, in this age of industrialization in which strength, durability and a longer working life are important qualities in tools and machinery, forged parts are widely used.

The forge, the anvil, and the hammer have been the basic tools of the forge shop worker throughout the history of the industry. With the harnessing of steam power, and the advent of the Industrial Revolution, however, certain changes began to appear in forge shops.

The development of the mechanical hammer and successive technological advances made in the field of metallurgy have expanded the scope of the forge shop as to the number, size and variety of forgings produced and the materials used. One of the most notable advances in forge shop production occurred during the 1860's when Sir Joseph Whitworth, an outstanding engineer

and tool maker of Manchester, England, had trouble in obtaining large steel castings possessing the proper qualities for the production of heavy artillery. To overcome this problem, he perfected a compressed steel process in which metal was subjected to high pressure while still in the fluid state and afterwards forged in hydraulic presses instead of hammers. Today, the products of forge shops are made from a number of different metals and alloys of metals and the equipment used ranges all the way from hand tools to power-driven hammers capable of striking a blow measured in hundreds of pounds many times a minute, and huge forge presses that can exert a "squeeze" of as much as 50,000 tons pressure.

The practice of identifying metal workers with the metal they used has resulted in a number of occupational titles such as goldsmith, silversmith, coppersmith, and tinsmith. The original forge shop worker became known as the blacksmith because he made his wares out of iron — the "black" metal. The expansion of industry and use of special machines for forge work permitted a subdivision of labour that was not formerly possible, and created the need for new skills and several new classes of workers. In modern forge shops, workers are identified with the machine they operate or the process they carry out, and are further classified according to the level of their skill.

The importance of the part played by the early metal workers in the history of Western Europe is apparent from the frequency with which Smith, Schmidt and similar names occur in Western populations. Throughout the Middle Ages, forge shop workers reached what might be considered as a high point in the industry. Depended upon by the knights and soldiers of those days for suits of armour and weapons of war, these workers were also prized by many feudal lords for their skill in making light-weight fancy-dress armour. Many fine examples of the armourer's work may be seen in museums the world over.

Today, forge shop workers are recognized as skilled workers who play an essential part in the shaping of metals for the many purposes to which modern industry puts them.

FIELD OF WORK

Forge shops occur mainly in the metal working industries. In many cases, they are maintained as departments of a larger

plant and produce forgings used in the products made by the plant. Independent shops, on the other hand, make forgings for sale to a variety of users. The greatest users of forge shop products are the manufacturers of automobiles, airplanes and farm machinery. Others requiring forged parts in varying amounts are the manufacturers of railroad rolling stock, hardware and tools, and general machinery. A number of forge shops operate as industrial repair shops for making new and replacement parts for equipment that has broken down, and making and sharpening tools, etc.

Shops operating in rural districts, mining areas and on construction jobs are mainly engaged in repairing mechanical equipment, and making and sharpening tools and drills.

NATURE OF THE WORK

Most forge shops fall into one of three categories — *production*, *repair* or *custom*. Production shops, whether large or small, are usually engaged in making a great number of forgings of the same design, whereas in repair shops each job may be different. Custom shops make forgings according to specification for a variety of users.

In large shops there is usually a high degree of mechanization and an extensive subdivision of labour. In these shops, the finished product is the result of the combined efforts of a crew of men each performing their own speciality. Also, the use of mechanical aids enables workers in this type of shop to produce larger as well as greatly increased numbers of forgings.

Small shops may be just as highly mechanized, but the size and scope of their products would be limited by the smaller size of their machines. They may be considered to be production shops but seldom produce items in large quantities and generally have greater variety in their individual jobs. Workers in a small shop may be required to do any one or all of the different tasks necessary to complete the forging of an article.

Forge shops located in rural, mining or construction areas are less likely to be mechanized and usually carry out repair and replacement work. The simplest forge shop of this type is the blacksmith shop. Much of the work done in a blacksmith shop is still done by the time-honoured hand methods of ancient days. In some cases, however, a small-sized drop hammer may

be used for certain articles that are too large for hand forging, or to produce a considerable number of small objects of relatively simple shape such as erection pins.

The duties of forge shop workers are affected by the size of forgings made, the degree of mechanization in the shop, and the type of forging process used. In order to understand the work involved in forging it is useful to consider first the duties of the all-round blacksmith who accomplishes on a small scale, using hand tools, that which production shops accomplish on a large scale, using special machines and employing many workers.

THE BLACKSMITH

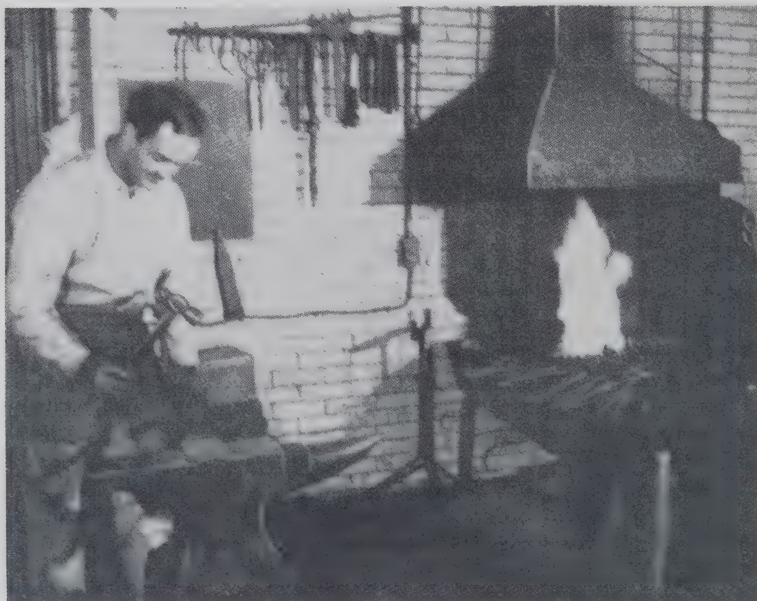

Photo: N.F.B.

The blacksmith is an all-round craftsman

DUTIES

The blacksmith is a highly skilled craftsman throughly familiar with, and capable of performing, all of the tasks necessary to complete the forging of an article.

He plans the job. Although he may be required to read and work from blueprints, the blacksmith usually works from written specifications or oral instructions. By visualizing the finished product and making what sketches and diagrams he feels are necessary, he estimates the amount of material that will be required for the job and then selects an appropriate piece of metal stock. In some cases, he will decide what type of metal is best suited for the job.

The blacksmith then determines the changes that must be made in the stock to obtain the desired shape. Finally he makes certain that the necessary tools, etc., are readily at hand and, should any special tools or shaping dies be required, he designs and forges them himself. The importance of planning lies in the fact that once he has started working on the metal the blacksmith must work quickly and will have little time to change his planned procedure. Furthermore, errors in estimating may result in the waste of both time and material.

He heats the metal. Heating metal is an art in itself. Different metals may be more easily worked at different temperatures. Also, metal that has been heated too quickly or has become too hot may burn and form scaly lumps which have to be removed. This could result in the waste of stock, particularly if it has previously been cut to size.

The blacksmith places the piece of metal stock in his forge and, by controlling the amount of fuel and regulating the force of air, he heats the metal to the correct working temperature. To gauge the temperature of the metal the blacksmith may use a *pyrometer* — an instrument used to measure extremely high temperatures. Usually, however, he will determine temperature by observing the changes that take place in the colour of the metal during heating. When the correct working temperature has been reached, the blacksmith removes the stock from the forge and places it on the anvil.

When handling heated metal, the blacksmith must be extremely careful. Usually, he grips the hot metal with a pair

of tongs, the jaws of which in many cases he has previously forged to fit the shape of the stock.

He shapes the metal. When shaping an article out of a piece of heated stock, the blacksmith either holds it in position or manipulates it on the anvil with one hand and wielding a hammer in the other hand, pounds it into the desired shape. Frequently, however, he must use a variety of forming tools and shaping dies. These he holds in position with the hand that normally wields the hammer and the hammering is done by an assistant.

The nature of the changes that are to be made in the stock determines the type of tool that will be used. "Flatters" are used to flatten and smooth the work, "fullers" to form rounded grooves, and "swages", which are made in two parts, are used to make round pieces. Holes are made with punches and are enlarged with "drifts". Shaped parts are cut away from the rest of the stock by means of a variety of cutting tools or "sets".

Although he makes use of many types of measuring devices such as calipers, rulers and templates, to check the dimensions of the article he is molding under the hammer, a blacksmith does much of the necessary measuring by sight alone. For this reason, he must have a good eye for shape and size. Also, as he works the metal, he keeps close watch on any colour changes that take place as it cools so that he may return the piece of metal to the forge for reheating if necessary.

In some cases, the shop may be equipped with a small drop-hammer that the blacksmith uses to forge articles that are too large for his anvil and hammer.

After a forging has been shaped to satisfaction, the blacksmith may harden and temper the metal. This is done by heating the metal to a certain degree and quickly cooling it in an oil bath or a water tank.

The blacksmith finishes a forged article by grinding imperfections off the surface and drilling any necessary holes. Also, he may weld parts together. This may be done by "fire welding" or by a more modern method such as oxyacetylene or electric arc.

TRAINING

The trend in recent years toward mechanizing much of the work done in a forge shop has resulted in a considerable reduction in the demand for all-round blacksmiths. There is still, however, a need for the blacksmith's skills in the production of certain items not required in great quantities, and in such areas of work as the repair and maintenance of tools and other pieces of equipment.

Designated as an apprenticeship trade only in the provinces of Manibota and New Brunswick, blacksmithing is nevertheless included in the apprenticeship training schemes operated by a number of companies located in other provinces.

Generally speaking, an apprenticeship course lasts four to five years and is open to applicants who can meet certain basic requirements with regard to age, health, and education, and can prove themselves during a short period of probation.

Throughout the training period the apprentice, working under the direction of a qualified journeyman, learns the operation and care of a forge, the proper heating of metals, the use of hand tools, various methods of forging, the hardening and tempering of metals, and acquires skill in estimating amounts of material required and in selecting appropriate pieces of stock for particular jobs. Furthermore, he spends a specified length of time in acquiring related technical knowledge either by attending a local trade or technical school, through classroom instruction within the plant, or by taking correspondence courses.

If the equipment is available, the apprentice is instructed in the forging and setting of dies for a power hammer or press, the operation of the machine, and the forging of articles with power equipment. Also, he learns the use of power drills, power hacksaws and grinders. In many cases he is taught the use of oxyacetylene or electric arc welding equipment.

The following outline describes the blacksmith training program operated by one company:

Requirements for entry: applicants must have passed their 15th birthday, have completed Grade 10 or equivalent, and be able to pass the company's medical examination. Preference is given to applicants who seem best suited for the job and are sons of present or retired employees.

Work schedule:

Time	Job Performed
6 months	— helping blacksmith — learning to operate power hammers,
6 months	— helping blacksmith — operating power hammers,
6 months	— bending, shaping & forming, round, square and flat iron,
6 months	— forge welding,
6 months	— small tools — hardening and tempering,
6 months	— small forgings,
6 months	— general blacksmith work — blueprint work,
6 months	— forgings — tools,
6 months	— jig work and die stamping,
6 months	— improvership — heavy forgings.

This work schedule totals 60 months. Throughout the period, time spent on technical training is credited as being hours worked, and the apprentice is paid a percentage of the journeyman's rate with increases at regular intervals. At the completion of the course, the apprentice is given a certificate signifying that he has qualified in the blacksmith's trade.

FORGE SHOP OCCUPATIONS

The modern production forge shop is an expansion of the original blacksmith's shop, with much of the equipment mechanized and a sub-division of labour. Forge shop work divides roughly into two main types of operations — ***heavy forging*** and ***drop-forging.***

Heavy forging is done by a crew of men working as a unit at a power-driven hammer that is equipped with open (or flat) dies. The force of the blow delivered by this type of hammer is controlled by the operator and can be varied according to the impact required. The jobs handled in this type of work are usually the larger ones requiring less need for working to close tolerances. Large-scale bending and forming is done to obtain gross shapes which are then finished to more accurate dimensions by chipping and grinding. Some of the workers require skills

Photo: Dominion Bridge Co. Ltd., Montreal

Heavy Forging is done by a crew of men working as a unit

and knowledge similar to the blacksmith's, as well as the ability to direct a number of workmen in close crew work.

The *hammersmith*, called *hammerman* in some shops and *forge crew leader* in others, is the most highly skilled worker in the shop. He must be able to read and work from blueprints or written specifications, have a knowledge of shop mathematics and be familiar with the general principles of forging and the properties of metals. He is in charge of the operation of the hammer and directs the work of the crew, which may consist of a hammer driver, a heater and one or more helpers.

The hammersmith supervises the heating of the metal, frequently checking the changes that occur in the temperature with a pyrometer or by observing colour changes. He directs the helpers in removing the metal from the forge and transporting it to the anvil plate of the hammer. This usually involves the use

of mechanical aids such as an overhead chain hoist. By means of hand signals or verbal instructions, the hammersmith directs the helpers in positioning and manipulating the stock, and indicates to the hammer driver the force and number of blows necessary to give the heated metal the desired shape.

The hammersmith may also supervise the cutting and trimming of the forgings and may check the dimensions of finished forgings with calipers, squares or other measuring devices.

The *hammer driver* is an assistant operator. Working under the direction of the hammersmith, he manipulates the controls of the hammer to regulate its stroke and thus govern the force of the blow.

Drop forging is usually done on a hammer equipped with closed (shaped) dies which, when brought together accurately, form a sort of mould. The top half of the die is fastened to the ram of the hammer; the bottom half is positioned on the bed of the hammer. The ram is raised by steam, air or other source of power and, when released, is allowed to drop of its own weight, bringing the dies together with constant force. The jobs handled in drop forging are usually smaller than those of heavy forging and are carried out to much closer tolerances. With a diversification of labour and the use of a variety of machines, forgings are passed from worker to worker on a production-line basis.

Drop-hammer operators position and manipulate the heated metal on the bottom half of the die and operate the controls of the hammer to strike the number of blows required to shape the metal. If the work is being hot-trimmed, they transfer the shaped part to a trimming press and, placing it in a cutting die, operate that machine to trim the work. Drop-hammer operators may be responsible for setting the dies in their machines, or it may be done by a *set-up man*.

One phase of drop forging work that is not usually found in heavy forgings is the production of the closed dies used in the hammers. There is a great deal of skilled work involved in the laying out of the die, die sinking, the use of automatic die-copying machines for contour forming, and the hand finishing and polishing of dies. A number of skilled workers are also engaged in die repair work. For a detailed description of die

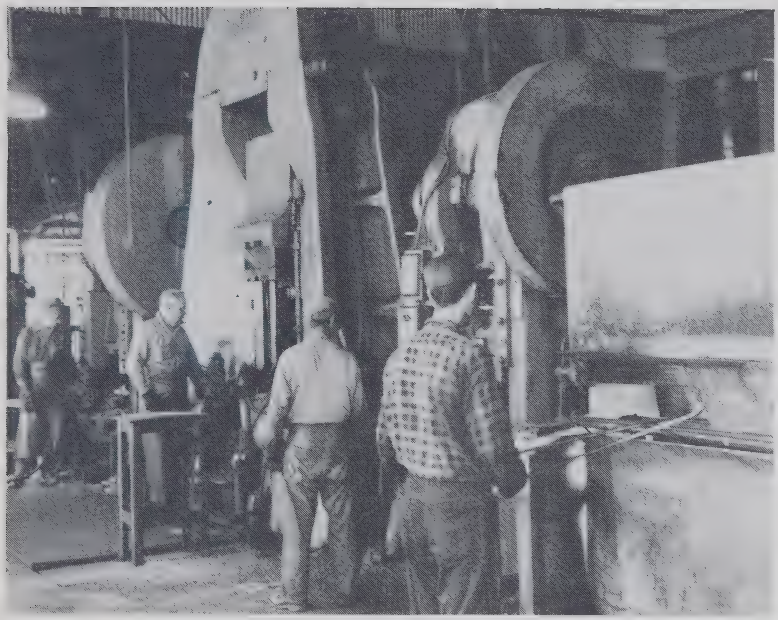

Photo: Steel Company of Canada, Gananoque Works

Forgings are passed from worker to worker

work, readers should consult CANADIAN OCCUPATIONS Monograph No. 18, *Tool and Die Maker.*

In all types of forging, a number of workers are required to work with hammersmiths or drop-hammer operators, or to carry out special forging operations.

Heaters, working under the direction of their respective operators, prepare metal stock for shaping by placing it in a forge and heating it to the correct working temperature at the correct rate. With the aid of helpers, they remove the heated stock from the forge and transport it to the anvil. Should the metal cool before forging has been completed, the heater returns the stock to the forge and reheats it, taking care not to spoil the work by overheating.

Forge-press operators are in charge of forging machines that shape metal through the exertion of force in the form of a slow squeeze rather than as a striking blow. They place heated metal in the die and operate the controls of the machine to press the metal into shape.

Upsettors operate forging machines equipped with closed dies that move in a horizontal direction. They are responsible for directing the work of the heater and helpers assigned to their press and also for adjusting the pressure of the machine.

A number of other workers are involved in the cleaning and finishing departments of a forge shop. *Trimmers* remove excess metal from forgings with a saw or trimming press, and are responsible for setting the dies in their machine; *chippers* and *grinders* use small hand hammers, chisels and abrasive wheels to smooth off surplus metal and imperfections; *blasters* clean the forgings with shot blasting machines — in some shops, blasts of steam are being used; *picklers* remove scale by dipping the forgings into an acid bath, and *heat treaters* alter the physical properties of forgings to produce a specified degree of hardness and strength. *Inspectors* check the size, quality and temper of finished forgings to see that they are up to the specified standards.

PREPARATION AND TRAINING

Educational requirements are not high. According to the 1951 Census of Canada, the majority of forge shop workers had from five to eight years of schooling, and a substantial number had less than five years of schooling. Less than one quarter had attended school more than eight years. Those wishing to progress to supervisory positions, however, should continue their education as long as possible. In fact, plants with formal apprenticeship training programs prefer their prospective apprentices to have junior matriculation so that they may have the necessary educational background to advance to supervisory rank. Generally speaking, employees should be able to work from blueprints or written specifications, take accurate measurements and do shop mathematics. Technical school shop courses or previous experience in a metal working occupation (machine shop, foundry or blacksmith shop), are useful but not essential prerequisites.

Training for most of the occupations in a forge shop is received on the job. In the case of some of the more highly

skilled tradesmen, such as Hammersmiths, a formal apprenticeship scheme similar to that required for Blacksmiths may be followed. Thorough training in this trade would include:

- Planning a job from work instructions,
- Methods of transporting work pieces in the shop,
- Use of standard blacksmith tools,
- Judging temperatures of metals by colour, or using a pyrometer to determine them,
- The operation and maintenance of forges (coal, coke, gas or oil fuelled),
- Characteristics of various types of iron, steel, and other metals lending themselves to the forging process, under heating and pressure,
- Operation of power hammers, large and small, in the shop,
- Selection and fitting of dies or blocks in hammers,
- Forging metal objects from heated stock.

To reach the skilled operator level through on-the-job training usually requires several years, depending on the ability of the worker, the equipment being used, the processes involved, and the opportunities that arise. A new worker usually starts as a helper on a hammer or press crew, remains with the same crew throughout his training, and progresses by means of upgrading as he gains in experience and knowledge of the work and as vacancies occur.

QUALIFICATIONS

Forge shop work is a man's job. The 1951 Census listed no women employed as blacksmiths, hammermen, and forgemen, and only a few as furnacemen and heaters. The usual age of entry for beginners and apprentices is from 15 to 21 years.

Forge shop workers must be physically strong and agile, as much of the work is heavy, and have the full use of both arms and hands. They must be able to lift heavy tools and dies, walk, stand, stoop, grasp hand tools, to see and hear clearly, and to speak audibly in a noisy shop. They must be able to tolerate working in heat and noise. In larger shops, teamwork is necessary and the individual must be able to work as a member of a group and to follow instructions.

Experience or instruction in the use of hand tools, or the ability to acquire the skill is necessary.

This work should appeal to those who need the satisfaction of seeing tangible results of their work.

ENTRY

Those desiring employment in forge shop work should enquire at the nearest local office of the National Employment Service, where they will receive assistance in locating suitable positions. In many cases, employment may be secured by applying directly to the employment office of a forge shop or a plant in which a forge shop is maintained. In some firms, preference is given to sons of employees.

ADVANCEMENT

New employees in a forge shop usually start as helpers on a drop-hammer or a forge-press crew. As they gain in experience and knowledge of the work, and as the opportunities arise, they may be upgraded to the position of heater. The more experienced heaters are selected to fill any vacancies that occur in the operators' positions. There are usually several levels of skilled operators, depending on the size and type of machines being used. In some cases, heaters may become hammer drivers (assistant operators) and following an additional period of training and experience, they may be advanced to the position of hammersmith. Further advancement to the jobs of shop foreman, superintendent, etc., will depend on the abilities of the individual workers and the size and requirements of the shop concerned. Employees who enter this work as apprentices will, on completion of their apprenticeship period, become journeymen.

WORKING CONDITIONS

Employment in a forge shop is not usually affected by seasonal changes, but will depend on the activity in the various industries in which forge shop workers are employed. Hot, noisy working conditions are standard and some dirt is unavoidable. Good housekeeping habits, however, keep many shops relatively clean. The work is physically strenuous and although the majority of the workers spend most of their time on their feet, some machine operators are seated at their jobs.

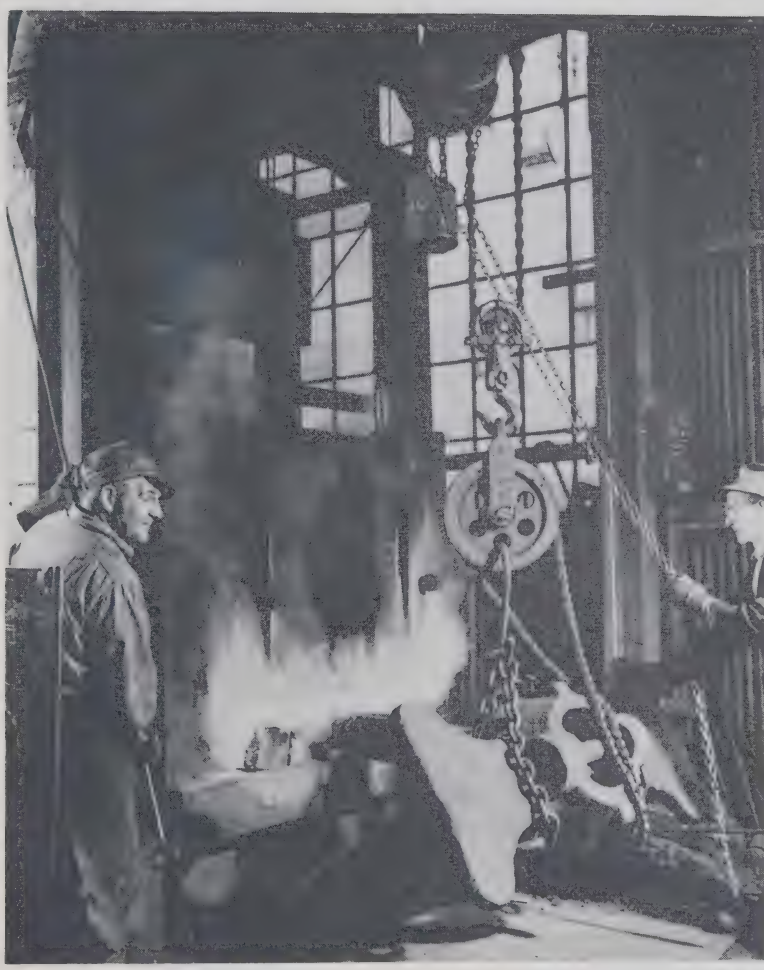

Photo: N.F.B.

Forging is hot, strenuous work

Employees in this industry usually work from 40 to 48 hours per week. They are eligible for benefits under the Unemployment

Insurance and Workmen's Compensation Acts and many of them enjoy other benefits such as pensions, holidays with pay, etc.

Earnings

Certain difficulties have been experienced in preparing reliable figures for the reporting of wage rates among forge shop workers. In many cases not sufficient numbers of workers are reported to yield statistically significant figures. The wide variation in wage rates reported for individual occupations indicates that workers of different levels of skill are being reported under one occupational title, in which case the high range indicates the wages received by more highly skilled workers. In addition, there is variation in wage rates for workers in different industries and for workers in different geographical locations. The following table is therefore offered with some reservation:

Hourly Wage Rates for Selected Forge Workers October, 1957

Occupation	*Hourly Wage Rate (On Time Work)*	*Hourly Straight-time Earnings (1)*
	$	$
Blacksmith	1.64-2.15	2.47-2.60
Drop-Hammer Operator (*Hammerman*), *Journeyman*	1.90-2.00	2.02-3.55
Forging-Press Operator (*Angle-Press Operator; Upsetter*), *Journeyman*	—	1.97-2.80
Grinder Operator (*External Grinder Operator; Internal Grinder Operator; Surface Grinder Operator*)	1.55-1.99	1.71-2.61
Hammersmith	1.90-2.33	—
Heater, Forge	1.50-1.94	1.60-2.38
Helpers	1.44-1.67	1.83-2.16

(1) Straight-time earnings derived from piece-work, incentive, or production bonus plans.

Source: Department of Labour, Canada.

Hazards

Forge shop workers guard against many of the occupational hazards that are encountered when working with hot metals, heavy materials and tools, overhead hoists, and moving machinery, by wearing helmets, safety boots, goggles and other protective clothing. Screens are used to protect workers from flying scale, and in some shops, electronic and mechanical safety devices are being incorporated into the operation of much of the equipment.

ORGANIZATIONS

The International Brotherhood of Boilermakers, Iron Shipbuilders, Blacksmiths, Forgers and Helpers is the union to which many of the employees of forge shops belong. In some industries, however, particularly those in which a forge shop is but one unit of a larger plant, the forge shop workers may be included with the workers from other divisions of the plant by the industrial union covering the plant as a whole.

TRENDS

Number in the Occupation

The number of Blacksmiths, Hammermen, and Forgemen, for all industries, recorded in the 1951 Census, totalled 9,587.

Industrial Distribution

The Manufacturing Industry, with its many and varied divisions, employed more than 7,600 of the total number of Blacksmiths, etc., recorded in the 1951 Census. Approximately 5,600 of these were engaged in the production of Iron and Steel products, 1,100 in the building of Transportation Equipment, and varying numbers in plants producing other items such as Foods and Beverages, Textile, Wood, Paper or Chemical Products, Electrical Apparatus and Supplies, and many others.

Geographic Distribution

According to the 1951 Census, approximately 3,200 Blacksmiths, etc., were located in the province of Quebec, 2,700 in Ontario, 1,100 in the Maritime provinces, and the remaining 2,400 were divided fairly evenly between the four Western Provinces.

That the total number of these workmen employed in the provinces of Quebec and Ontario accounts for more than 60% of the national total may be attributed to the fact that the greater part of the Manufacturing Industry is located within these two provinces.

Growth

The number of persons engaged in forge shop occupations over the past few years has decreased. A comparison of the figures for the last three Census periods illustrates this point. According to the 1931 Census, there were 16,388 persons listed as Blacksmiths, Hammermen and Forgemen. This number dropped slightly by 1941 to 15,114, then dropped sharply to 9,587 by 1951.

Although the number of forge shop workers declined considerably from 1941 to 1951, the value of forgings produced by Miscellaneous Iron and Steel manufacturers in 1951 was slightly greater. The indication is that mechanization is increasing output per worker.

Outlook

The prospects for continued industrial expansion in Canada indicate that the employment outlook for skilled metal-working craftsmen in general is good. In some respects, however, the product of the forge shop is in competition with similar products of the foundry and machine shop. The success with which forgings meet this competition will be an important factor in the outlook for forge shop workers. The unique quality of strength in forgings (described previously), together with improvements in techniques which permit production of a wider variety of forgings, with closer tolerances, indicates that forge work will remain a strong contender in the metal-working crafts.

Another factor in the employment outlook is the possibility of increased production per worker as a result of mechanization. Such a development will tend to reduce employment opportunities. The degree of mechanization and technological change possible in forge work varies, depending on the type of forging done. In heavy, open-die work the skill of the hammersmith and his crew is difficult to replace by machines, and mechanization is confined to improvements in handling metal stock before

and after the forging process. The heavy-forging craft itself remains unchanged.

The production of smaller forgings by closed dies and drop-hammers is evidence of mechanization, with a division of labour and some reduction of the skill required. It is possible that further mechanization may increase production per worker. On the other hand, however, as the closed dies in use become more intricate and precise to meet the more exacting demands of industry, greater skill and care must be exercised by the operator in manipulating metal stock under the hammer.

The trade of the blacksmith as an all-round craftsman, defined on page 7, has been declining for many years, owing to the decline of the general blacksmith shop. There will be a continuing need for blacksmiths throughout industry, however, to carry out special fabricating, repair and maintenance jobs best suited to his particular skills. As in the case of most declining trades, training opportunities for prospective newcomers tend to become more limited.

FURTHER READING

Ministry of Labour and National Service, London, England, "Choice of Careers", New Series No. 36, *The Blacksmith*, (1952).

U.S. Department of Labor, Bulletin No. 1215. *Occupational, Outlook Handbook*, (1957 Edition), "Forge Shop Occupations", pp. 360-363 and "Blacksmiths", pp. 364-366.

International Brotherhood of Boilermakers, Iron Shipbuilders, Blacksmiths, Forgers and Helpers — *The Boilermakers-Blacksmiths Journal* (monthly).

LOCAL INFORMATION

LOCAL INFORMATION

LOCAL INFORMATION

CANADIAN OCCUPATIONS FILMSTRIPS

The Department of Labour has prepared, to date, the following occupational filmstrips in collaboration with the National Film Board. A manual has been prepared as an accompaniment to each filmstrip. These may be purchased from the National Film Board, Box 6100, Montreal, or from any one of its regional offices.

- Plumber, Pipefitter and Steamfitter
- Careers in the Engineering Profession
- The Social Worker
- Technical Occupations in Radio and Electronics
- Bricklayer and Stone-Mason
- Printing Trades
- Careers in Natural Science
- Careers in Home Economics
- Motor Vehicle Mechanic
- Mining Occupations
- Draughtsman
- Careers in Construction
- Machine Shop Occupations
- Careers in Meteorology
- Medical Laboratory Technologist (in colour)
- Teacher (in colour)

DEPARTMENT OF LABOUR

Economics and Research Branch

CANADA, 1959

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CANADIAN OCCUPATIONS

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FORGE SHOP OCCUPATIONS

MONOGRAPH 17

DEPARTMENT OF LABOUR, OTTAWA

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HON. MILTON F. GREGG, V.C., MINISTER
ARTHUR MACNAMARA, C.M.G., LL.D., DEPUTY MINISTER

DEPARTMENT OF LABOUR, OTTAWA

FOREWORD

During recent years there has been a steadily increasing demand for up-to-date information on occupations.

This demand comes from youth faced with the need of choosing an occupation and of selecting the type of training required, from parents, teachers and other counsellors; from workers shifting to other occupations; from employment service officers; from directors of personnel and union officials, and from other quarters.

This series of monographs and an accompanying series of pamphlets, the latter containing similar information in a condensed form, are attempts to meet this demand.

These publications represent an expansion of an earlier series issued by the Department of Veterans Affairs to assist members of the armed forces returning to civilian life following the end of the war. These current series, designed for general use, cover a wide range of occupations, including professions. They indicate, among other things, the nature of the occupations or group of occupations, entrance and training requirements, working conditions and opportunities in each.

The monographs have been prepared by our research staff working on occupations, with the generous help and advice of officials of the Unemployment Insurance Commission, Vocational Training Branch of the Department of Labour, Dominion Bureau of Statistics, Provincial Departments of Education and of Labour, employers' associations, trade unions, professional associations, and other government and non-government bodies.

Grateful acknowledgement is made of this assistance and that obtained from numerous publications on occupations prepared in Canada and in other countries.

DIRECTOR,
Economics and Research Branch,
Department of Labour.

February 1952.

FORGE SHOP OCCUPATIONS

Photo N.F.B.

Stamping out an Aeroplane Propeller

HISTORY AND IMPORTANCE

The use of the forge — an open furnace using air blast — and the hammer and anvil was common to the very early metal-workers, whether they worked tin, bronze, silver, copper, steel or wrought iron. From the primitive workshops, hand tools and muscle-power of mythical Vulcan and traditional Tubal Cain to the great factory and up to 50,000-ton-pressure hydraulic forging press of modern times, we find a progressive elaboration and enlargement of process and tools. Yet we find hand-forged articles in use and demand, and the blacksmith is still an important artisan in the economy of the most advanced industrial nations.

That the worker in metal forging was always an important man in Western Europe is evidenced by the frequency of Smiths, Schmidts, and bearers of equivalent names in Western populations. Their ancestors must have had a high rate of survival throughout the invasions and feudal, civil, religious and national wars of the Dark, Middle and Renaissance Ages. No conqueror would willingly include these useful artisans in the conventional massacre and looting which followed the capture of a town or city. No other English name is as common as "Smith".

The forge shop of modern industry has an important and essential part in the production of metal objects and parts. Its products are generally distinguished by the possession of greater strength, given by a grain following the contours of the object, than can be obtained by the casting, machining or stamping processes. Thus they have a longer working life.

FIELD OF FORGE WORK

The most appropriate use of forging is for the making of objects with fairly simple shapes and contours, basically

flat, with only moderate detail on the surface, and with no internal cavities. Finishing for fine tolerances and the addition of holes for bolts, etc., are generally done by machining the forging; shot-blasting for surface finish is used, as in foundries. Some forgings are heat treated.

It must be noted, however, that such round objects as guns, and railway engine and ship's transmission shafts are forged, any hollows being made by machine boring after forging. During the last war shells were forged and pressed on specially designed hydraulic presses.

Basically, heated steel (or alloy), wrought iron, monel, or other workable metal is beaten (by a hand, a steam hammer or a drop hammer) or pressed (by a forging press), using dies, in some cases, into shape. Some objects are forged cold.

Industries using forged products include: Aircraft; Automotive; Farm Machinery; Shipbuilding; Armament; Railway Rolling Stock; General Machinery; Hardware and Tools; Ornamental Metal; Boilermaking.

In most cases the forge shop may be an integral part of an establishment which uses also machining, casting and stamping to create its finished products. Some other companies specialize in the forging process.

The forging process is generally more costly than is casting.

OCCUPATIONS IN THE INDUSTRY

The basic workers, deriving directly from the blacksmith of old, are the *hammermen*, who operate the mechanical hammers which have largely superseded human muscle and the old hand tools. The blow on the metal is exerted downward by the falling die in the case of drop-hammers.

The dies used may be specially shaped, or plain. *Upsetters* operate machines exerting horizontal pressure. *Heaters* and *helpers* are workers assisting in these processes. A highly skilled *die maker* makes the dies in the tool room or in the plant which specializes in the production of dies.

DUTIES

There are functional differences in the duties of *hammermen*, according to the type of machine used.

Drop-Hammer Operators are skilled workers, operating a machine using shaped dies. They direct the work of the *heater*, who prepares the metal; they supervise their own helpers. They may direct the setting up of the hammer.

Hammersmiths are highly skilled workers, operating a hammer using flat or "open" dies, with which the metal is pounded into the required shape. They supervise several men, including an assistant called a *hammer driver*, *a heater*, and *helpers*.

Since these workers must manipulate the hammer and control its stroke, and must be able to read blue-prints, (and manipulate the metal as well as the hammer), their skill is rated highly. They must understand the properties of the metals used, be able to use simple shop arithmetic, and be familiar with general forging practice.

Forging-press operators operate machines which shape metal by squeezing it between shaped or "closed" dies. They supervise their crews, including a heater and helpers. Duties include heat control, regulation of the pressure of the press, setting of the dies when necessary, and the proper placing of the material to be forged. These presses are chiefly used in production of large forgings, and recently large articles, such as aeroplane wing panels, the material for which is not

heated prior to pressure, have been made by this process. New 50,000-ton hydraulic forging presses may make panels as large as 8 ft. by 10 ft.

Upsetters operate an "upsetter" forging machine, which uses shaped dies moving horizontally. They direct their heaters and helpers. Duties include control of heat, adjustment of machine's pressure, and correct placing of stock between dies.

Heaters prepare metal for forging by heating the stock in a furnace. They control the furnace, place in it metal stock, remove stock when properly heated, and transfer it to the forging machine under the supervision of the upsetter.

Specialized job titles shown in the United States "Dictionary of Occupational Titles" include:

(1) Drop-hammer operator II; Pneumatic-drop-hammer operator; Restrike-hammer operator; Steam-hammer operator; Drop-hammer operator III; Trip-hammer operator; Power-hammer operator (boilermaking). These are operators of different mechanical hammers.

(2) Forging-press operator; Four-column-hydraulic-press operator; Sectional hydraulic-press operator; Angle-press operator (shipbuilding); Forming-press operator I; Flanging-press operator; Extruding-press operator; Sectional-hydraulic-press leverman; Trimming-press operator (boilermaking, structural and ornamental metal). These are operators of different presses in forging.

(3) Die setters (forging); Die setter (drop-hammer).

(4) Forge welder (steel wheels).

(5) Heat treater; Hot forging inspector.

Helpers and labourers, and the supervisory, clerical, accounting, sales and executive staffs needed for the opera-

tion of the individual plant, complete the personnel of this industry.

BLACKSMITH

The above occupations apply to the larger mechanized plants; the small *custom forge shops*, producing ornamental iron work, fire-escapes and other metal fittings which must be made to fit individual buildings, hand tools for special jobs, and repairs or replacements for agricultural machine parts, need the services of *blacksmiths*.

A typical shop of this kind will have as its key man a *blacksmith* who has served his apprenticeship in this trade. His duties include the use of hand tools employed with an anvil; the making of simple dies, which may be in the form of special hammers, or upper and lower dies connected by tongs; the use of a small power hammer. He may also forge tools for use in the lathe or other tool-equipped machine.

QUALIFICATIONS

Persons accepted for training in the skilled aspects of this industry should preferably have had experience or instruction in the use of hand tools, and ability to acquire skill in this. Preference is given to those who have had a technical course, or some experience, in blacksmith shop practice.

The physical demands of this industry's skilled jobs are an important factor; prospective trainees should be alert, able to lift heavy tools and dies, walk, stand, stoop, grasp hand tools, to see and hear clearly, and to speak audibly in a noisy shop.

Photo N.F.B.

Blacksmith using hand tools

TRAINING

Training for skilled work as a *hammersmith* in forge shops is acquired either on the job, or as an apprentice blacksmith. Formal apprenticeship lasts four years. Training on the job will be as a shop helper, or as a helper on a specific job. Thorough training, giving the opportunity to learn the trade, includes:

- Planning a job from work instructions,
- Methods of transporting work pieces in the shop,
- Use of standard blacksmith tools,
- Judging temperatures of metals by colour, or using a pyrometer to determine them,

The operation and maintenance of forges (coal, coke, gas or oil fuelled),

Characteristics of various types of iron, steel, and other metals lending themselves to the forging process, under heating and pressure,

Operation of power hammers, large and small in the shop,

Selection and fitting of dies or blocks in hammer,

Forging metal objects from heated stocks.

Training as a *press operator* is on the job. Entry is as a helper, and the time taken to learn the skill requisite varies from one to three years, according to the types and variety of machines used, and to the ability of the trainee.

No formal training is necessary for other occupations peculiar to this industry. Tool and die makers, common to several branches of metal manufacturing, are dealt with in a special monograph in this series.

ENTERING OCCUPATION

Employment as a helper, or where a vacancy exists, as an apprentice, should be sought through the agency of the National Employment Service, unless the applicant has personal knowledge of an opening.

EARNINGS

The industries in which forge work is done are varied. It may, however, be concluded that wages correspond, on the basis of the skills involved, with those in heavy industry generally.

ADVANCEMENT

Advancement is, in this industry, from apprentice or helper to journeyman, in the case of the skilled workers.

Opportunities for further promotion would depend on the size of the shop and the ability of the worker.

RELATED OCCUPATIONS

There are no occupations closely related to those of forge shops. Such general relationship as foundry and sheet-metal occupations bear to much of the work in forge shops is not great. Certain jewellery workers use, in work on a much reduced scale, skills akin to those of the higher grades of forge-shop workers.

ADVANTAGES AND DISADVANTAGES

The constructive nature of the work, and the personal skill and judgment involved in the more responsible tasks, make for satisfaction in what the worker accomplishes.

Earnings are in the range of the production occupations in heavy industry.

There is no evidence of over-crowding in the skilled groups.

Since much of the employment is in large-scale establishments, working conditions can be expected to be favourable. Noise and heat are, of course, unavoidable, but there are no abnormal hazards to health.

ORGANIZATIONS

Workers in the forge shop trades have their own union, The International Brotherhood of Blacksmiths, Drop Forgers and Helpers. They may be included, however, in industrial unions where the forge shop is integrated with a plant producing goods into the fabrication of which forging enters only as one process.

Number in Occupation, and Distribution

The census figures for 1941, a year in which the heavy industry development was certainly far below that of present times, gives a total of *blacksmiths*, *hammermen*, and *forgemen* of 15,114, all male.

Of this number 994 were engaged in primary industries; 743 of these were in mining.

The remainder were listed under manufacturing. The largest groups were:

Blacksmithing — Forge	9,095
Railway Rolling Stock	540
Foundry Products	499
Primary Iron Products	611
Transportation and Communication	356
Shipbuilding and Repair	291
Boilers, Engines, Machinery	247
Construction	204
Farm Machinery	197
Other Iron Products	196
Hardware and Tools	179
Automobiles and Cycles	176
Saw and Planing Mills	151
Carriages, Wagons, Sleighs	144
Service	142
Munitions and Armaments	121

Small numbers were employed in other industries which included: Pulp and paper; aircraft; firearms and guns; sheet metal products; shells and bombs; tanks and

universal carriers; wire and wire products; brass and copper products; non-ferrous smelting and refining; chemical; petroleum; electric light and power; gas; explosives.

Growth

As above indicated, it cannot be assumed that 1941 figures have any validity in 1952 as a basis for the number and distribution of the key workers concerned. Consideration of the expansion of such industries as aircraft, automobile, shipbuilding, and armaments, as well as of such technological changes as, for example, the almost complete turnover in locomotive building from steam to diesel-electric, is necessary. Results of the 1951 census will show, on comparison with the 1941 figures, the trend of expansion.

Present Demand and Supply

Some indication of the changing demand and supply in these occupations is given by the following data, supplied by the Dominion Bureau of Statistics, and based on the operations of local offices of the National Employment Service of the Unemployment Insurance Commission:

Blacksmiths, Forgemen, Heat and Mechanical Treaters

	Unfilled Vacancies	*Unplaced Applicants*
2 Feb. 1950	21	1,254
28 Sept. 1950	247	597
31 May 1951	93	344

It must be remembered, in considering the above figures, that they cover only those vacancies and applicants reported to the Commission's offices, and that it is probable that a fair proportion of vacancies are filled through direct contact. Also, a factor affecting the number of applicants is

the registration by persons actually employed who desire a change.

There is no evidence of any over-supply of apprentices. Trade sources state that there is still a demand for apprentices in general blacksmithing. This applies especially to the custom shops where hand work is part of most jobs.

Future Prospects

Under present conditions, it is clear that, particularly in the aircraft, shipbuilding, machinery, armaments, and railway rolling stock industries, there is an increasing demand for forge-shop products.

Technological changes, involving the fabrication by forge presses of articles previously moulded or machined, and great increases in the size and power of these presses, will have a marked effect on this branch of industry. Jet aeroplanes, diesel-electric engines, new fighting vehicles, and new alloys will all affect the use of the forging process. In the case of aeroplane wings, for example, press forging eliminates riveting and reduces weight. New moulding processes, involving the casting of powdered alloys, may have a competitive effect in the case of such articles as turbine blades.

Within the industry itself, there is a trend towards less hammer and more press work. Since the latter requires, with modern equipment, much less skill than does the former, this is likely to affect training requirements.

Other factors having incidence on employment in this industrial group include the price and availability of steel and alloys, the expansion or contraction of heavy industry generally, the volume of export trade, the currency situation in relation to export, effective demand for durable consumer goods, and the state of the mining and the paper and pulp industries.

Conclusion

Since this is an industry largely serving, or integrated with, the heavy metallic industries, its future is affected by the state of these, as well as by the general condition of the Canadian economy.

REFERENCES

United States Department of Labor, Job Family Series, *Occupations Related to Drop-hammer Operator* (1943).

United States Bureau of Manpower Utilization, Interviewing Aids: *Drop-hammer Operator I; Forging-press Operator*. Job Descriptions: *Hammer-smith; Drop-hammer Operator II; Drop-hammer Operator IV; Blacksmith II; Four-column-hydraulic-press Operator*. (1942-43).

United States Department of Labor, Occupational Outlook Summary, *Employment Outlook in Forge Shop Occupations* (1949).

Business Week magazine, 25 April 1951, Page 44 et seq., (Press forging, aircraft); 10 February, 1951, Page 77 et seq., (article on forge work and developments).

TRADE PUBLICATIONS

Steel Processing (Steel Publications, Inc., Pittsburg 30, Pa., U.S.A.).

AUDIO-VISUAL MATERIAL

Readers desiring information on film sources, available material, and the organization of local film services may obtain it from the National Film Board Offices listed in Monograph 1, "Carpenter".

"CANADIAN OCCUPATIONS" SERIES

The monographs listed below, accompanied by pamphlets, except in the case of numbers 13 and 20-35, have been published to date. Those from 20-35 have been published collectively.

(1) *Carpenter*
(2) *Bricklayers and Stone-Masons*
(3) *Plasterer*
(4) *Painter*
(5) *Plumber, Pipe Fitter and Steam Fitter*
(6) *Sheet-Metal Worker*
(7) *Electrician*
(8) *Machinist and Machine Operators (Metal)*
(9) *Printing Trades*
(10) *Motor Vehicle Mechanic and Repairman*
(11) *Optometrist*
(12) *Social Worker*
(13) *Lawyer*
(14) *Mining Occupations*
(15) *Foundry Workers*
(16) *Technical Occupations in Radio and Electronics*
(17) *Forge Shop Occupations*

Careers in Natural Science and Engineering: (20-35)

(20) Agricultural Scientist
(21) Architect
(22) Biologist
(23) Chemist
(24) Geologist
(25) Physicist
(26) Aeronautical Engineer
(27) Ceramic Engineer
(28) Chemical Engineer
(29) Civil Engineer
(30) Electrical Engineer
(31) Forest Engineer and Forest Scientists
(32) Mechanical Engineer
(33) Metallurgical Engineer
(34) Mining Engineer
(35) Petroleum Engineer

DEPARTMENT OF LABOUR

Economics and Research Branch

OTTAWA, 1952

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OTTAWA

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TOOL and DIE MAKERS

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TOOL AND DIE MAKERS

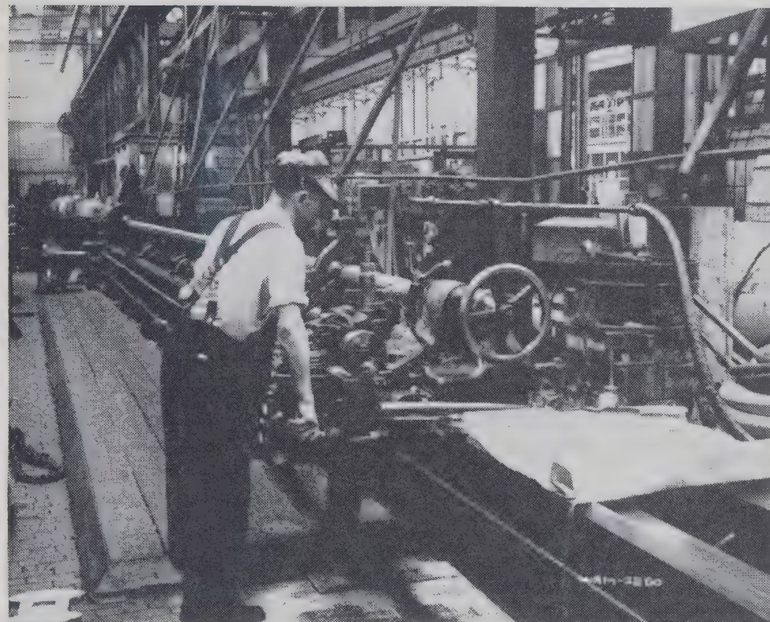

Photo N.F.B.

A toolmaker at work

HISTORY AND IMPORTANCE

The occupation of Tool and Die Maker had its origin in the same circumstances as that of Machinist.

The introduction of powerful prime movers, steam or electrically operated, made possible the use of hard steel tools to shape metal parts by cutting, and of hard steel dies to stamp sheets of metal into desired shapes.

At the same time, these prime movers made possible great speeds of operation in machinery of all types, domestic, industrial or transportation. Since with increased

speeds there is increased friction, efficient operation of such machinery depends upon a reduction of this friction to a minimum, and this necessitates exceedingly fine fitting, with "tolerances" so low as to be expressed in as many as five decimal points of an inch.

To produce tools which will make parts with such a degree of accuracy is obviously the work of men who have attained a high standard of skill in this specific field.

The increase in industrial manufacturing, especially in that of metal goods, which has taken place in Canada during the last forty years, and which has been greatly accelerated and intensified since 1939, accompanied as it has been by an almost universal adoption of assembly-line methods, has created a corresponding need for tool and die makers. At the time of writing, re-armament has begun to make additional demands on the metal-working industries; since it requires many products not previously manufactured in Canada, the appearance of advertisements for tool and die makers by large contractors is a regular feature in most of the city daily newspapers.

FIELD OF EMPLOYMENT

Tool and die makers are necessary wherever a new product requiring finely machined metal parts is made. Among industries employing relatively large numbers are: Aircraft, Automotive, Shipbuilding, Railways, Armaments, Machinery, Machine Tools, Electrical Appliances and Agricultural Machinery.

DUTIES

The following details of the duties of an all-round Tool and Die Worker are taken from a Job Description published by the United States Department of Labor.

Job Summary

Constructs and repairs metal-forming tools, dies, jigs, fixtures, and gauges, shaping the parts with various metal-working machines and assembling them with machinist's hand tools.

Work Performed

1. Determines work procedure: Studies blueprints, models, work sketch, or other instruction to determine specifications for new tool, die, jig, fixture, or gauge; selects suitable stock and lays out workpiece for initial cutting operations by establishing center and reference points and guide lines, using rule, surface gauges, dividers, protractor, and marking devices such as scriber and center punch; determines requirements and sequence of subsequent cutting operations on machines such as power hacksaw (for cutting stock roughly to size and shape), milling machine, planer, or shaper (for making plane cuts), engine lathe or turret lathe (for turning cylindrical stock to size), drill press, jig borer or boring mill (to drill holes), and internal, surface, or universal grinders for finish grinding.

2. Sets up and operates machines to produce tool, die, jig, fixture, or gauge parts of fine tolerances. Establishes additional reference points and guide lines on workpiece; sets up workpiece in appropriate machine by fastening it onto machine table, securing it between centers, or fastening it into jig or fixture; may build up holding device, using wood or metal blocks, straps, bolts, or clamps, installs dividing head, if required, as on a milling machine to make accurately spaced cuts at precise angles; bolts or clamps cutting tool to tool carriage of machine; turns crank or handwheel to bring work or tools into position for each cut; moves levers, shifts belt or gears to control speed and feed of machine; moves control lever or switch to start machine and observes operation; stops machine at intervals to inspect work and make measurements with scale, calipers, micrometer, or other gauges.

3. Fits and assembles finished parts: Chips, files, and scrapes surfaces of machined parts, usually finishing them to very close tolerances, using hand tools such as chisel, file, and scraper; assembles parts and fastens them together with screws and bolts; may weld or braze parts during assembly; checks completed tool, die, jig, fixture, or gauge, using precision measuring instruments, for conformity to original specifications, and makes necessary alterations.

4. Repairs and maintains tools, dies, jigs, fixtures, and gauges. Studies worn tool or die to determine nature of repair necessary to salvage it for further use; disassembles if necessary and performs required machining operations to refinish tool or die; may make replacement parts, following original specifications and finishing with hand tools to fit accurately into place; checks accuracy of gauges and measuring devices, using standard gauges such as Matrix or Johansson blocks, and makes necessary adjustments, using hand tools, to bring them within specific tolerances; sharpens cutting tools and cleans, oils, and adjusts machine tools.

5. May perform related tasks: Design dies, tools, jigs, fixtures, and gauges; make clay, glass, wood or metal models in the process of developing tools, dies, jigs,

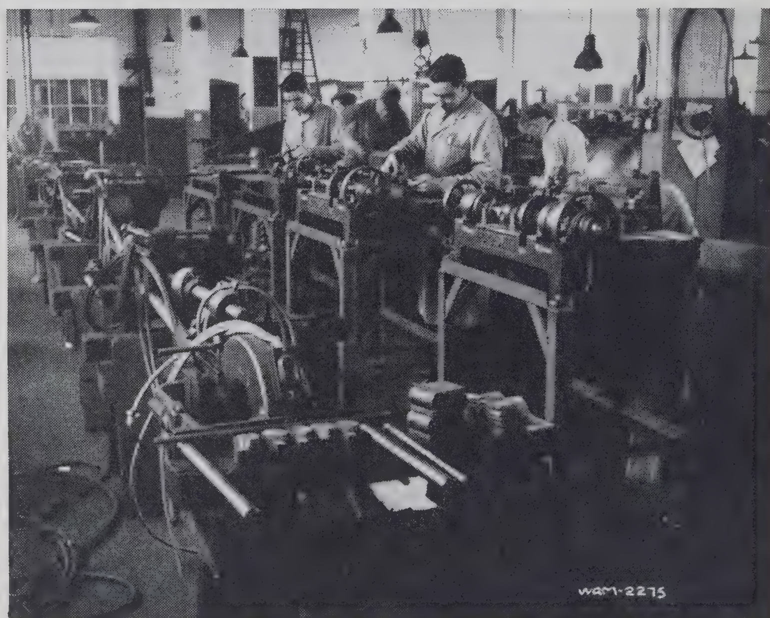

Photo N.F.B.

Manufacturing machine tools

fixtures, and gauges; heat-treat metal parts by heating in a furnace to specified temperature and quenching them in oil or water or letting them cool slowly; make minor repairs or report condition to maintenance man; sharpen cutting tools on grinding machines; estimate job costs and time.

Though it is possible for many workers in these trades to combine, or to practise alternatively, a number of the duties listed below, *there is a definite tendency towards specialization*, especially in large establishments. Accordingly, the following *job descriptions* have been listed, with details adapted from those in the United States Dictionary of Occupational Titles:

Tool Maker (machine shop) Specializes in the construction, repair, maintenance and calibration of machine-shop tools, jigs, fixtures and instruments, operating various machine tools and performing other highly skilled work, such as laying out, fitting, and assembling parts.

Cam Maker (machine shop) Fabricates and repairs cams to govern the operation of machine tools.

Diamond Mounter (automobile manufacturing) Sets diamonds in tools used for re-surfacing grinding wheels, and in diamond-pointed cutting tools.

Fixture Maker (machine shop) Specializes in the construction and repair of fixtures.

Forming-Tool Maker (machine shop) Lays out and machines to exact size and shape forming tools used in machining of automobile tire molds.

Gauge Maker (machine shop) *Benchman.* Specializes in the construction and repair of various types of precision gauges used to check the accuracy of machine work.

Jig Maker (machine shop) *jig mechanic; jig worker; template maker;* Specializes in the making and repairing of jigs.

(Note: a "jig" is a device for holding in place material worked on by tools, also used as a guide for tools. Often called "fixture")

Tool Maker, Bench (machine shop) *benchman.* Fits and assembles, according to specifications, light machinery, gauges and cutting tools, scraping, filling, joining, and testing parts.

Tool Repairman (machine shop) Repairs tools, jigs, and fixtures used in cutting machines by reshaping, sharpening, and refinishing them by hand, using files, abrasives, and other hand equipment, and by machine, using grinding wheels, polishing wheels, and other power-driven equipment. Inspects work visually and tactually.

Tool Straightener (machine shop) Corrects warping of metal-cutting tools developed during heat treating. Heats warped area with a hand torch or by putting the warped portion of the tool in a furnace. Straightens heated section with hand tools or a hand press or arbor press. May use special device which shows high spots on a recording dial when piece is revolved on blocks in contact with feeler point of gauge.

Tool Troubleman (machine shop) *tool adjuster.* Inspects cutting tools that do not operate satisfactorily and adjusts them by grinding and other operations.

Die Maker (machine shop) *die cutter; form-block maker.* Specializes in the construction, repair, and maintenance of dies for forging, punching, stamping, or other metal-forming work.

Die Finisher (machine shop) *clearing-hammer operator; die barber; die fitter; die scraper; die trimmer; draw-die finisher.* Smooths and finishes the surface of dies after they have been cast, heat treated, or machined, filling, scraping, and grinding the dies, and fitting multiple-part dies together.

Die Grinder (machine shop) Grinds the internal surfaces of dies to accurate dimensions, on a precision grinding machine.

Die Maker, Forge (machine shop) Finishes forge dies by hand, scraping, grinding, and filing machined dies to exact dimensions.

Die Maker, Trim (machine shop) *trimmer maker.* Makes dies for trimming flash (excess metal) from edges of forging.

Die Polisher (wire) Reconditions worn wire-drawing dies. Laps, turns, grinds, files, and cleans dies, using lapping machines, bench lathes, power grinders, and hand tools. Inspects dies for smoothness by touch or by use of instrument giving degree of finish in micro inch value. Verifies diameters of dies by manually forcing a piece of wire through reconditioned dies and gauging wire for size, using micrometer calipers.

Die Sinker (machine shop) May make or finish dies, but usually performs a particular operation on sets of dies, such as cutting designs or lettering called for in the finished product, or cutting, by routing and profiling operations, deep cavities in forge dies.

Die-Try-Out Man (machine shop) *die fitter; die-lead-off man; die setter; die troubleman.* Performs the original set-up, try-out, and final adjustment of new dies, and repairs worn dies used in a sheet-metal press. Bolts upper die in ram and lower die in bed of press. Paints upper die one colour and lower die another. Operates machine through its cycle by running driving motor a few revolutions at a time until upper die descends into lower die. Examines dies for mixing of two colours of paint as an indication of high spots. Files, grinds, and chisels high spots, indicated by mixing of two paint colours, using hand and power tools, until dies fit. Paints template (accurate pattern of finished stamping) and inserts it in machine. Brings dies together slowly with template between them, removes template from dies, notes further high spots (recorded by paint rubbed from template to dies), and further grinds, files, chisels, scrapes, and polishes dies.

Edgerman (machine shop) Operates various types of metal-working machinery, such as planer, shaper, or milling machine, to reduce the edges and other surfaces of dies to accurate dimensions.

Die Maker (Jewellery) *die cutter; hub cutter.* Makes a set of dies to be used in forming metal blanks into various shapes for jewellery. Marks out outline of design on flat surface of soft steel block with pointed instrument following sketch. Mounts block in small vice and cuts out lines of design, using small hand tools (Engraver, Jewellery). Chips and cuts away metal to form image represented on sketch, using small metalworking machines and gauges. Hardens and tempers steel block or "hub" *(Hardener,* heat treat), *Temperer* (heat treat), and drives it into another block of soft steel to form sunken design, using a press *(Drop Hand),* or sends hub to machine shop for processing. Cleans design in hardened half of die with hand tools. Engraves other half of die in a soft steel block, working from sketch or from a template formed by pounding thin sheets of metal into completed half of die. Hardens and tempers second part of die, or sends it to machine shop for processing. May engrave lettering and designs into dies, using a pantograph engraving machine (Engraver I (printing and publishing)).

Forcer Maker (Jewellery) Makes the upper (forcer) die used in shaping jewellery; Cuts steel block to size, using an automatic hacksaw. Impresses the previously carved, raised design or the lower die into the steel block, using a drop hammer (Drop Hand). Removes excess metal from imprint made by the lower die on the upper die, using a milling machine (Milling-Machine Operator I). Shapes the upper die, carefully following the impression made by the lower die, using various hand tools, such as chisels and files. Hardens and tempers the die. Polishes the die so that a mirrorlike finish will be imparted to the metal to be shaped.

Where original tools or dies are to be made, the maker works in accordance with plans and specifications prepared by a *Tool Designer* or *Die Designer* (a professional engineer, often). The finished product must be heat-treated to the proper degree of hardness, and must also be tempered, and tested for accuracy and efficiency.

QUALIFICATIONS

Educationally, these craftsmen need to be well prepared. A knowledge of mathematics, up to Senior Matricu-

lation standards, is most desirable. Training in draughting, and in machine shop practice, is valuable.

The extreme accuracy necessary in much of the work makes good eyesight a definite requirement, and since much work must be performed standing, muscular condition must be good. As duties involve mental exercise, concentration on the problem in hand, and co-operation with fellow-workers, these craftsmen should be free from any neurotic tendencies.

There are few, if any, women in these occupations.

The usual apprenticeship entry age is in the range of 16-20 years.

TRAINING

Prospective apprentices would do well to consider the type of shop, its equipment, and the opportunities to learn skills, before deciding to apply to any particular company.

Pre-apprenticeship training may be obtained in draughting and machine shop work in technical schools in most provinces. In Ontario the Ryerson Institute of Technology, Toronto, gives a two-year course, open to Junior Matriculants, in Tool and Die Making. The Moncton Technical Institute in New Brunswick has, also, a course in these trades. Some instruction may be obtained from correspondence schools. A few large companies provide their own training courses in their factories.

ENTERING OCCUPATION

Regular entry to these trades is through apprenticeship, generally a four-year engagement. There is no provincial legislation covering this, however, and the line of demarcation between a skilled machinist and these tradesmen is not a very solid one.

Some companies allow credit on apprenticeship time, up to a year, for graduation in related work from approved technical or vocational schools.

Enquiry as to apprenticeship openings may be made through the offices of the National Employment Service.

A personal tool kit is usually acquired during training. Its cost now varies from $400 to as high as $1,000, according to the type of plant in which work is being done.

EARNINGS

Apprentice rates of pay in these trades follow, in a general way, those in the skilled trades; that is, they are on a percentage basis in relation to those of journeyman. Roughly speaking, the initial percentage is 50, and increases of 5¢ per hour are given every six months. The quality of training and the facilities for learning skills should be regarded as a more important factor than initial earnings.

In Ontario, and in some other provinces, the apprentice spends a further year as an "improver", usually specializing, before being given journeyman status.

Journeyman's rates will vary according to the length of qualification, to skill, to duties performed, and to any supervisory responsibilities, such as those of inspectors, charge hands, or foremen.

The following rates were recorded in October 1951, in cities where employment of these craftsmen was considerable:

WAGE RATES FOR TOOL AND DIE MAKERS IN SELECTED CITIES, OCTOBER, 1951.

Note:—The figures shown below are based on a sample survey covering 1,655 workers in the three trades.

Locality	Toolmaker		Diemaker		Tool and Die Maker	
	Average Rate per Hour	Predominant Range	Average Rate per Hour	Predominant Range	Average Rate per Hour	Predominant Range
	$	$	$	$	$	$
Montreal......	1.49	1.30-1.68	1.38	1.04-1.64	1.50	1.25-1.70
Toronto........	1.65	1.48-1.80	1.55	1.35-1.70	1.64	1.44-1.91
Windsor.......	1.78	1.72-1.90	1.84	1.48-2.40	1.69	1.60-1.85
Vancouver.....	1.91	1.78-2.00	..	—	1.94(1)	—

(1)Predominant rate.

The wide spread in rates in the three cities first listed will indicate the variety in skills and responsibilities involved in these trades.

Hours of work will, under present circumstances, vary greatly according to the exigencies of the establishment.

Overtime will be in accordance with the union agreements in each shop or with each industry.

Since October 1951 there has been a trend towards increase in rates of pay generally, and in some industries these are governed by an "escalator" clause relating them to the Cost-of-Living Index. Readers are advised to consult local employers, or union representatives, as to current conditions, and to read the Annual Reports on Wage Rates and Hours of Labour issued by this Department.

ADVANCEMENT

In view of what has been noted above as to the relation of pay rates to duties, it is clear that advancement for journeymen is likely to be from simpler tasks to more complicated ones. In a large establishment the most skilled men may become charge hands, at the head of a team of workers, or inspectors, or eventually foremen or tool estimators. Advancement is slow until skill is attained. There are possibilities of owning a small custom shop.

RELATED OCCUPATIONS

The work of a machinist is very closely related to that of a tool or die maker. Less close, because requiring less skill, are the duties of a machine operator (metal). A metal pattern maker shares some of the higher skills of the tool or die maker.

The tool designer, a professional man, and the draughtsman who prepares the necessary drawings of the tool or die, must understand the materials and uses of the objects designed.

Toolmakers' assistants, performing routine duties, are ancillary to these trades.

ADVANTAGES AND DISADVANTAGES

These occupations, requiring a long training period, meticulous work, adaptability, a sound technical education, and a stable personality, are highly respected. Newer than the building crafts, they have become essential to the modern industrial economy.

The work itself is not monotonous, and involves planning and responsibility; the satisfaction arising from achievement of a task well done is part of the "psychological income" of these trades. The considerable disparity in living costs between the various centres is also a factor which should be taken into account, and it is likely that apparent differences in hourly earnings may not be very great in real earnings.

The monetary income, while not markedly high for the skills involved, at least provides a reasonably good living standard. Many plants give paid vacations and sick benefits. Pensions and retirement plans are in effect in some large establishments. Unemployment Insurance is available to these trades.

The disadvantages of this type of work are those associated with metal-working industries generally. These include noise, metallic dust, some dirt and grease; in poorly managed or equipped shops there may be bad lighting or inconvenient arrangement of machines and supplies.

A local shortage of necessary metals may involve a reduction of earnings temporarily; an urgent re-tooling job may mean much overtime, or working night shifts. It is sometimes necessary to change employers, since new tools are not regularly required by all metal-working industries or establishments.

ORGANIZATIONS

Since these crafts are not numerically strong in any one industry, and are usually represented by only small numbers in any establishment, their members are generally included in the ranks of the appropriate industrial or craft unions which predominate in their places of

employment. In machine shops and similar establishments they are likely to belong to the International Association of Machinists; in Quebec to an appropriate Catholic syndicate in some places.

There is no Canadian union peculiar to these trades themselves.

TRENDS

Number in Occupation

At the present time it is, in view of the decade which has passed since the 1941 census, and of the marked changes which have taken place in industry during and immediately after World War II, and during the "Cold War" and Korean war periods, impossible to estimate the number in these trades.

The fact that there were 7,276 tool and die makers in 1941, an increase of about 155 per cent over the 1931 figures, may serve as some index to the effect of the far greater changes above referred to.

Working Life

It is generally conceded that these craftsmen have a longer working life than have members of most trades. There are no recent data to confirm this, but it takes so long to attain all the skills involved that a competent man is retained as long as possible.

Present Labour Demand and Supply

The Korean war and its implications have, at the time of writing this monograph, greatly stimulated the demand for tool and die makers. Advertisements by large and reputable firms engaged in armament production, aircraft-building and ship-building call for these tradesmen, and have been appearing in a number of newspapers with large circulations.

No separate figures for current demand and supply are available from National Employment Service records, in

which these trades are *included with that of Machinist* in a single related group. The figures for this group on March 1st and March 29th, 1951 show:

	Unfilled Vacancies		Unplaced Applicants	
	March 1	March 29	March 1	March 29
Canada	627	946	921	803
Atlantic region	24	56	98	80
Quebec	147	294	377	312
Ontario	419	547	193	167
Prairies	18	28	67	70
Pacific	19	21	186	174

The over-all figures for Canada on December 29th, 1950 showed 480 vacancies and 1,022 unplaced applicants—a surplus of 542 applicants as compared with one of 294 two months, and a shortage of 143 three months later. On 3rd May, 1951 the total vacancies rose to 1,129, with only 599 applicants. In Ontario vacancies exceeded applicants by 490, in Quebec by 150. By the end of May there were 1,910 vacancies and only 496 applicants for Canada as a whole. Since re-tooling precedes much use of machines by machinists, it is reasonable to infer that the surplus of tool and die makers, if any, was small. Moreover, not all employers and not all applicants are represented, since much employment in trades as specialized as these is obtained by direct contact.

Future Employment Prospects

It must be remembered that the engineering trades, mass production manufacturing, the electrical industry, radio, television, radar, aircraft, instruments and household utilities are all based on efficient tool designing and skilled tool makers to produce the production tools before production can be planned and started. Therefore, this

trade, upon which all industrial progress is based, is of vast importance.

The immediate future of these crafts appears to be one of steady employment and of considerable demand. The world situation in the matter of armaments, the availability of metals to industry, limitations on consumer credit for durable goods, and any expansion or contraction of the automobile and aircraft industries, will have marked effects on the machine trades.

Any attempt to foresee the long-term prospects of these trades would be futile. The counsellor or student who follows current events will be able to form his own conclusions, as conditions change.

A factor not mentioned above, however, will need to be considered. Technological changes are, in the metal-industry, favourable to a further need for tool-makers and die-makers.

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Department of Labour, Ottawa, "Canadian Occupations" Monograph 8, *Machinist*, 1950. *Wage Rates and Hours of Labour in Canada* (annual).

Department of Labor, U.S. Employment Service, Washington, D.C., *Transfer and Up-grading Suggestions for Occupations in Machine Tool Manufacturing*, 1946; *Job Description for Tool-and-Die Maker*, 1947; *Occupational Outlook Handbook*, Pages 230 et. seq., chapter, *Machine Shop Occupations*, including pages 236-7 *Tool and Die Makers* (1949); *Occupational Outlook Handbook*, 1951 Edition, Pages 186-195.

PERIODICALS

Machine and Tool Blue Book (monthly)
Hitchcock Publishing Company, Wheaton, Ill., U.S.A.

Modern Machine Shop (monthly)
Gardner Publications, Inc., 431 Main Street, Cincinnati, O., U.S.A.

American Machinist (weekly)
McGraw-Hill Publishing Company, Inc., 330 West 42nd Street, New York 18, N.Y., U.S.A.

AUDIO-VISUAL MATERIAL

Information on film sources, other available material, and the organization of local film services may be obtained from the office of the National Film Board, listed in our Monograph 1, "Carpenter".

LOCAL INFORMATION

LOCAL INFORMATION

"CANADIAN OCCUPATIONS" SERIES

The monographs listed below, accompanied by pamphlets except in the case of number 13 have been published. Numbers 20-35 are in a single volume.

(1) *Carpenter*
(2) *Bricklayers and Stone-Masons*
(3) *Plasterer*
(4) *Painter*
(5) *Plumber, Pipe Fitter and Steam Fitter*
(6) *Sheet-Metal Worker*
(7) *Electrician*
(8) *Machinist and Machine Operators (Metal)*
(9) *Printing Trades*
(10) *Motor Vehicle Mechanic and Repairman*
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(16) *Technical Occupations in Radio and Electronics*
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Careers in Natural Science and Engineering: (20-35)

(20) "Agricultural Scientist"
(21) "Architect"
(22) "Biologist"
(23) "Chemist"
(24) "Geologist"
(25) "Physicist"
(26) "Aeronautical Engineer"
(27) "Ceramic Engineer"
(28) "Chemical Engineer"
(29) "Civil Engineer"
(30) "Electrical Engineer"
(31) "Forest Engineer and Forest Scientists"
(32) "Mechanical Engineer"
(33) "Metallurgical Engineer"
(34) "Mining Engineer"
(35) "Petroleum Engineer"

DEPARTMENT OF LABOUR

Economics and Research Branch

OTTAWA, 1952

OTTAWA
EDMOND CLOUTIER, C.M.G., O.A., D.S.P.,
QUEEN'S PRINTER AND CONTROLLER OF STATIONERY

CANADIAN OCCUPATIONS

★

TOOL and DIE MAKER

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MONOGRAPH 18

REVISED 1959

DEPARTMENT OF LABOUR, CANADA

CANADIAN OCCUPATIONS MONOGRAPHS

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(10) Motor Vehicle Mechanic
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CANADIAN OCCUPATIONS

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TOOL and DIE MAKER

MONOGRAPH 18

REVISED 1959

HON. MICHAEL STARR, MINISTER

A. H. BROWN, DEPUTY MINISTER

DEPARTMENT OF LABOUR, CANADA

PRINTED IN CANADA

17

CONTENTS

HISTORY and IMPORTANCE 4

FIELD OF WORK 6

NATURE OF THE WORK 6

DUTIES 6

QUALIFICATIONS 9

PREPARATION and TRAINING 10

ENTRY 13

WORKING CONDITIONS 13

- Hazards 14
- Earnings 15

ADVANCEMENT 15

RELATED OCCUPATIONS 15

ORGANIZATIONS 16

TRENDS 16

- Number in the Occupation 16
- Growth 16
- Age Distribution 16
- Industrial and Geographic Distribution 16
- Outlook 17

FURTHER READING 18

FILMSTRIP 18

APPENDIX A 18

B 20

FOREWORD

During recent years there has been a steadily increasing demand for Canadian occupational information. The demand comes from youth faced with the need of choosing an occupation and preparing for it; from parents, teachers and vocational guidance counsellors; from workers wishing to change their occupations; from employment service officers; from personnel directors and union officials, and from other quarters.

The CANADIAN OCCUPATIONS series of monographs is designed to help meet this demand. Each booklet describes, among other things, the nature of the occupation or groups of occupations, entrance and training requirements, working conditions and employment outlook.

Occupational information tends to become dated as a result of changes in economic conditions, in industrial technology and in wage and salary structure. Revision of outdated publications is a regular feature of this series, and space is left in the last few pages of each monograph in which to note changes and other local information concerning the occupation.

This series has been prepared with the generous assistance of representatives of management, trade unions and professional associations. The co-operation of the Unemployment Insurance Commission, the Vocational Training Branch of the Department of Labour, and the Dominion Bureau of Statistics is gratefully acknowledged.

This monograph was revised by H. Stuart Fisher under the direction of William Allison, Chief of the Occupational Analysis Section. Grateful acknowledgement is extended to the Northern Electric Company, Montreal, the Steel Company of Canada, Gananoque Works, the Ketchum Manufacturing Company Limited, Ottawa, and Toolcraft Limited, Ottawa for their help and co-operation in supplying information.

DIRECTOR,
Economics and Research Branch,
Department of Labour.

January 1959.

TOOL and DIE MAKER

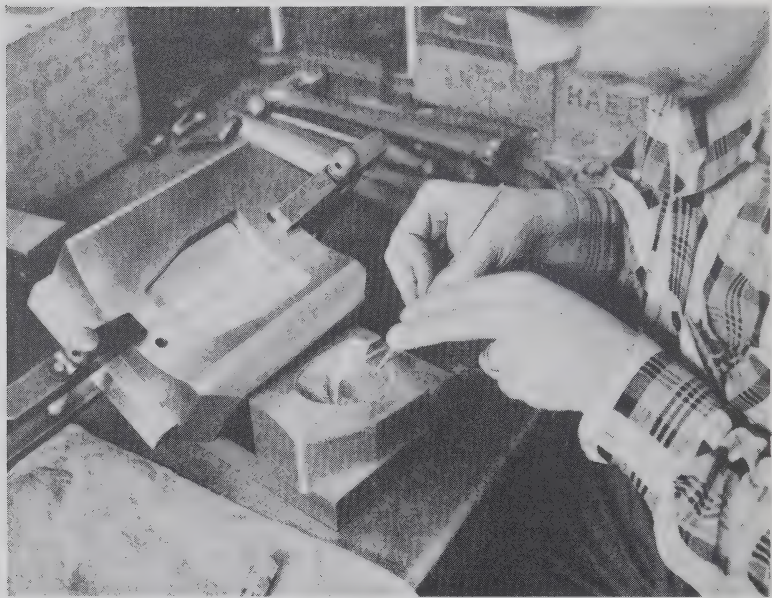

Photo: N.F.B.

Hand-finishing a forming die

HISTORY and IMPORTANCE

Tool making and die making, as we know them today, are comparatively new occupations. Whereas blacksmiths and many other metal workers can trace their trade origins back until they are lost in antiquity, tool makers and die makers find that their predecessors date back no further than the Industrial Revolution of the 18th century.

The technological advances that started in that period resulted in the growth of a group of skilled craftsmen called machinists who could turn out metal products at a faster rate and with a higher degree of accuracy than the most skilled hand craftsmen of that day (see CANADIAN OCCUPATIONS Monograph No. 8, *Machinist and Machine Operators*). This in turn created the need for a new type of machinist — the tool and die maker —

with an even greater amount of skill to produce the tools and holding devices so essential to the accurate machining of metal and also to make and calibrate the instruments and gauges used to check the accuracy of the work.

The importance of tool and die makers became apparent with the development of assembly-line methods of mass production. The quality of the finished product depends as much on the accuracy of the tools, jigs, dies and gauges that are used in the production of the individual parts, as it does on the skills of the many different workmen who make and assemble them.

Today, tool makers and die makers work to such fine tolerances, and require such high levels of skill, that they are truly the elite of all the metal craftsmen. Tool makers, for example, may construct a jig which enables a machine to perform mechanically many operations that normally require the skill of a machinist, thus permitting the work to be carried out by a less

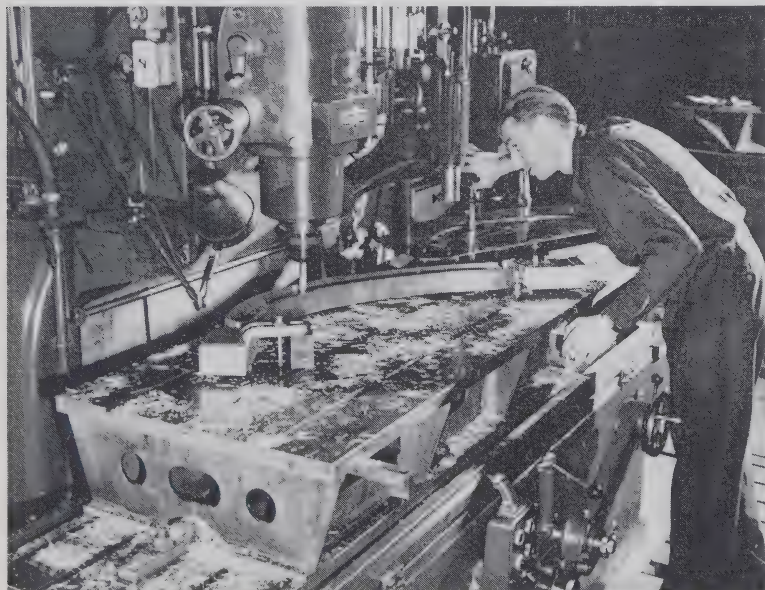

Photo: N.F.B.

The jig that guides this machine provides a pattern from which many identical parts may be shaped

skilled machine operator. Although tool and die making has been referred to as if it were a single trade, it is really two trades, tool making and die making. Workers who have mastered both skills are thus conveniently referred to as tool and die makers.

FIELD OF WORK

Tool and die makers tend to concentrate in metal-working industries that are engaged in the manufacture of such items as aircraft parts, automobile parts and accessories, agricultural equipment, heavy machinery, machine tools, and electrical apparatus and supplies. Others work in custom or job shops making tools and dies for manufacturers. Still others may be engaged in repair work.

NATURE OF THE WORK

Tool and die making is a highly skilled occupation, and is classed as a *key* job in metal manufacturing. The work entails much thoughtful planning, familiarity with complex machining and other metal-shaping operations and a thorough knowledge of, and ability to use, a variety of metal-working machines. It requires knowledge of the properties of metals, their uses and limitations, considerable manual skill and the ability to work very hard metals with an extremely high degree of accuracy. Tool and die making is usually quite varied and, at times, may even call for original tool design.

DUTIES

The scope of this occupation is such that although, in some cases, a highly skilled craftsman may be classed as an all-round tool and die maker, the common practice in industry is that he be regarded either as a tool maker or as a die maker. Furthermore, there is a definite tendency within each area of work for further specialization in but one aspect of the trade such as, forming-tool maker, jig maker, die grinder, die finisher, etc.

The *tool maker* is responsible for the construction of the cutting tools that are used by machinists and machine operators to shape rough metal stock into useable parts. He also makes the many different types of jigs and fixtures used to hold metal stock and tools in place during the machining process. Furthermore, he often makes and calibrates the gauges and other measuring instruments used to check the accuracy of the machine part.

Maintenance and repair of tools, jigs and fixtures is another of the tool maker's responsibilities.

The *die maker* is primarily concerned with the construction of the dies that cut or shape metal, and the fitting of dies to forging, stamping, punching and other similar metal-shaping machines. The die maker also does repair and maintenance work on worn or broken dies.

A complete job description for a tool maker is in many ways similar to that of the die maker. Both work from blueprints, written specifications, samples or models, and must be able to plan their work procedures from any of these media. They may be called upon to work in conjunction with a tool or die designer, and may even be expected to do some designing on their own, making their own sketches and drawings as necessary. In many cases, they may have to visualize the required tool and make a model of it out of wood, clay or metal. Frequently, they are called upon to estimate the amount of material necessary for a particular job, the time required to do it, and the expected cost. They may also decide what type of metal is best suited for the job and, therefore, must be familiar with the properties and characteristics of various metals such as aluminum, brass, copper, iron, steel and others.

Tool and die makers lay out their jobs on metal stock using dividers, rulers and scribers. Then, making extensive use of a number of metal-working machines — power hacksaws, lathes, planers, shapers, milling machines, grinders, borers, and even presses — they shape the individual parts. The dimensions of the shaped parts are carefully checked with calipers, micrometers, rulers or other gauges, and then finished, fitted and assembled with machinists' hand tools such as files, chisels, hammers, and wrenches. The tool makers and die makers may then set up the completed tool or die in the machine in which it is to be used, and make a few trial runs to see that it is functioning properly.

Tool and die makers must be familiar with a number of other metal working processes including forging, heat treating, welding and brazing and, at times, may be required to do this work. In some cases, the more highly skilled tool makers and die makers may be required to supervise and check the work of others, and also to instruct apprentices.

In some shops, although the tool and die maker must be capable of carrying out all the various aspects of the work, the making of tools, dies, jigs, etc., may be broken down into several

individual operations, each being handled by a specialist. Generally, the precise hand or machine finishing of the work remains the task of the skilled tool or die maker. The marking of the stock, however, and the initial or rough machining may be done by a skilled lay-out man and a machinist or machine operator. Hardening and tempering of the metal may be under the direction of a skilled worker in the heat treating section of the shop. The completed part is then checked by the inspection department.

The following are brief job descriptions adapted from the United States *Dictionary of Occupational Titles* for a number of the individual jobs in which tool and die makers may specialize:

Cam Maker (machine shop) Fabricates and repairs cams to govern the operation of machine tools.

Diamond Mounter (automobile manufacturing) Sets diamonds in tools used for resurfacing grinding wheels, and in diamond-pointed cutting tools.

Fixture Maker (machine shop) Specializes in the construction and repair of fixtures.

Forming-Tool Maker (machine shop) Lays out and machines to exact size and shape forming tools used in machining of automobile tire molds.

Gauge Maker (machine shop) *benchman.* Specializes in the construction and repair of various types of precision gauges used to check the accuracy of machine work.

Jig Maker (machine shop) *jig mechanic; jig worker; template maker.* Specializes in the making and repairing of jigs.

Tool Maker, Bench (machine shop) *benchman.* Fits and assembles, according to specifications, light machinery, gauges and cutting tools, scraping, filing, joining, and testing parts.

Tool Repairman (machine shop) Repairs tools, jigs and fixtures used in cutting machines by reshaping, sharpening, and refinishing them by hand and by machine.

Tool Straightener (machine shop) Corrects warping of metal-cutting tools developed during heat treating. Heats the warped area with a hand torch or by putting the warped portion of the tool in a furnace. Straightens heated section with hand tools or a hand press or arbor press. May use special device which shows high spots on a recording dial when piece is revolved on blocks in contact with the feeler point of gauge.

Tool Troubleman (machine shop) *tool adjuster.* Inspects cutting tools that do not operate satisfactorily and adjusts them by grinding and other operations.

Die Finisher (machine shop) *clearing hammer operator; die barber; die fitter; die scraper; die trimmer; draw-die finisher.* Smooths and finishes the surface of dies after they have been cast, heat treated or machined,

filing, scraping and grinding the dies, and fitting multiple-part dies together.

Die Grinder (machine shop) Grinds the internal surface of dies to accurate dimensions on a precision grinding machine.

Die Maker, Forge (machine shop) Finishes forge dies by hand, scraping, grinding, and filing machined dies to exact dimensions.

Die Maker, Trim (machine shop) *trimmer maker* Makes dies for trimming flash (excess metal) from edges of forging.

Die polisher (wire) Reconditions worn wire-drawing dies. Laps, turns, grinds, files, and cleans dies, using lapping machines, bench lathes, power grinders, and hand tools. Inspects dies for smoothness by touch or by use of instrument giving degree of finish in micro inch value. Verifies diameters of dies by manually forcing a piece of wire through reconditioned dies and gauging wire for size using micrometer calipers.

Die Sinker (machine shop) May make or finish dies, but usually performs a particular operation on sets of dies, such as cutting designs or lettering called for in the finished product, or cutting, by routing and profiling operations, deep cavities in forge dies.

Die-Try-Out Man (machine shop) *die fitter; die-lead-off man; die setter; die troubleman.* Performs the original set-up, try-out, and final adjustment of new dies, and repairs worn dies used in a sheet-metal press. Files, grinds, and chisels high spots, using hand and power tools, until the dies fit. Polishes fitted dies.

Edgerman (machine shop) Operates various types of metal-working machinery, such as planer, shaper, or milling machine, to reduce the edges and other surfaces of dies to accurate dimensions.

QUALIFICATIONS

Tool and die makers must have a high degree of mechanical aptitude, a liking for making things requiring close attention to the smallest detail, and the patience and ability to work with hand or machine tools to exceedingly fine tolerances.

In addition to taking orders and following instructions, tool and die makers must also be capable of planning for themselves, have a certain amount of creative ability and be able to form mental pictures of articles from written or oral instructions.

Tool and die makers should have average strength, and be able to spend fairly long periods on their feet. They must be able to grasp and manipulate a variety of hand tools such as hammers, chisels, files, and wrenches, etc., as well as the spindles, cranks and levers of machine tools. Normal eye-hand co-ordination and finger dexterity are all that is required of these workers, however, to attain the high standards of accuracy to which they must work. Keen eyesight, steady hands and high perceptive

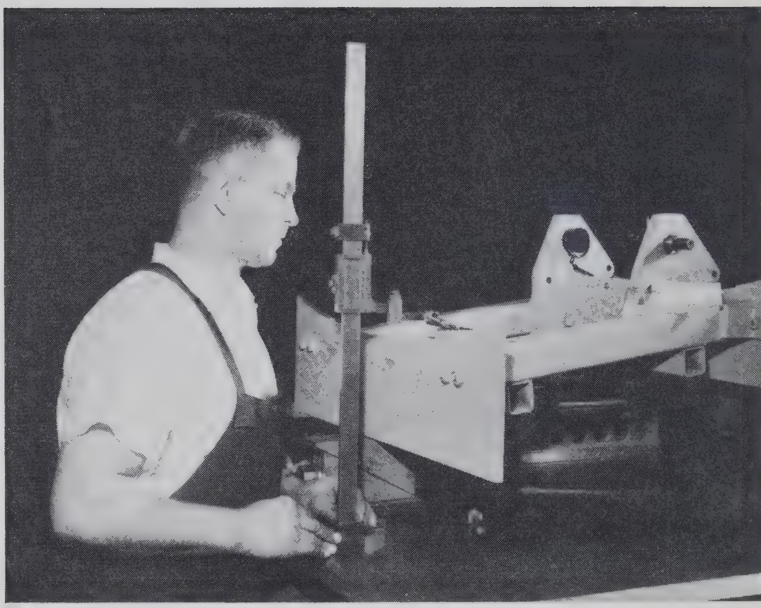

Photo: N.F.B.

Keen eyesight, steady hands and mechanical aptitude are important

ability with regard to form and space are all essential. Also, tool and die makers must be able to work under pressure in the presence of considerable shop noise.

Tool and die work would be appealing to mechanically minded persons who like change and variety in their work, and the challenge of solving new technical problems.

PREPARATION and TRAINING

Young men interested in a career as a tool maker or die maker should begin their preparation by completing at least four years of high school with a maximum of mathematics, particularly shop mathematics. If possible, they should follow courses in blueprint reading, draughting techniques and machine shop practice. Basic science courses in chemistry, physics — with emphasis on mechanics — and metallurgy, would be valuable assets. Part-time employment in and around a machine shop as

helper or as a machine-tool operator would provide prospective tool and die makers with important pre-training experience.

In most cases, training for this occupation is received through an apprenticeship training program, and it may be an extension of training for machinists. Since this is not a designated trade, however, the apprenticeship schemes are operated privately by various companies and, although they are generally similar in content, there might be some minor differences. Some companies have one training course for tool makers and one for die makers, others have a general course for both.

Normal entry age for apprenticeship ranges from 16 to 23, and applicants are required to have a minimum education equivalent to at least Grade XI. In some cases, they must have completed Grade XII and even Grade XIII. Most company apprenticeship schemes require applicants to pass a physical examination and, in a number of cases, entrance examinations are held.

The long period of training required before one can qualify as a journeyman in this trade may be considered by some as a disadvantage. The apprentice earns wages while he learns, however, and in some cases a bonus is paid when the training is completed. Furthermore, it must be remembered that one does not become a highly skilled craftsman overnight.

Generally speaking, a typical apprenticeship training program for tool and die makers lasts four years. The first three months are usually considered a period of probation. Training consists of a series of practical assignments, progressively increasing in complexity, supplemented by specified periods of classroom instruction in technical and non-technical subjects related to the trade.

The practical assignments are designed to acquaint the apprentice with all the aspects of the work and provide him with the opportunity to acquire skill and experience with the many types of tools, machines, instruments and processes that are used in this trade.

The facilities for carrying out the training program may vary from one company to another. In some cases, a fully equipped trade school may be operated; in others a particular area of the shop may be equipped and designated as a training section. In still others, trainees are assigned directly to the production shop and their training is fitted into the production schedule. Where

special training areas or schools are used, the final period of practical training is usually spent in the production shop as an improver.

The number of assignments and the period of time spent on each will depend to a great extent on the size of the shop, the diversity of its products, and the variety of equipment available. Working under the direction of a qualified journeyman or instructor, the apprentice learns how to operate many types of metal working machines such as planers, shapers, lathes, milling machines, grinding machines and boring machines. Also, he spends specified periods of time working in the tool and steel crib; heat treating metals; inspecting, testing and trying out parts, and doing specialized work. Bench work is a phase of training in which he becomes familiar with the standard hand tools and measuring instruments used by machinists, and gains experience in finishing and fitting machined parts.

Classroom instruction is also received in various ways. In some companies classes are held in the trade school, in others a classroom is maintained within the plant. In either case, the instructor may be a journeyman who has taken some teacher training, or a fully qualified teacher. In shops where facilities are not available for classroom instruction, the apprentice may attend either the day or the night classes at a local technical or vocational school. When this is necessary, the company frequently assumes responsibility for part or all of the cost of attending the courses.

Some of the subjects that are considered essential in these trade-related courses are as follows: shop mathematics, mechanical drawing, blueprint reading, machine and tool design, metallurgy, jig and fixture design, production planning, and technical report writing. In one company, tool maker apprentices are required to take a course in applied psychology.

Appendix A contains a list of vocational correspondence courses, available from the various provinces, that might be of some value to persons interested in preparing for the trade. Courses in tool and die making are available from schools such as Ryerson Institute of Technology, Toronto; New Brunswick Technical Institute, Moncton; and others of similar nature. A technical course in tool making is offered at the Montreal Technical School by the Quebec Department of Social Welfare and Youth.

In most apprenticeship schemes, records of progress are kept for each type of training, and at the completion of the apprenticeship period, a certificate is granted. In a number of companies, trade tests are given at intervals throughout the period of training and a final trade test must be passed before an apprentice receives his certificate.

Over the four-year training period, an apprentice is expected to acquire his own tool kit. Since these kits cost around $500, depending on the work he is doing, the apprentice, in many cases, is assisted with this expense by the company.

ENTRY

Students leaving school to find their first job may apply to local offices of the National Employment Service, where they will be given every assistance in locating suitable employment. Students graduating from secondary schools where they have received shop training may obtain assistance from the school placement officer.

Many employers use the employment columns of daily newspapers to advertise their requirements for qualified tool and die makers. Job-seekers may also apply directly to employing firms, and employment leads can be located in the Yellow Pages of the telephone directory under "Tool Makers", "Die Makers", "Steel", etc.

Those intent on becoming well qualified tool and die makers should select firms known to have good training programs. Application should be made as early as possible, since such firms generally have a waiting list. These firms are selective about taking on apprentices, preferring those with good educational background and vocational or technical school training. Some firms make it a practice to give preference to applicants who are recommended by their own employees, and it may be valuable, therefore, to have friends already in the trade.

WORKING CONDITIONS

Tool and die making is done indoors and is not usually affected by seasonal weather changes. Hours of work are the same as those for other tradesmen in the industry concerned, and the working conditions are generally quite good. As a rule, the work area is well equipped and well lighted. Although the presence of some grease, oil, dirt and metallic dust are un-

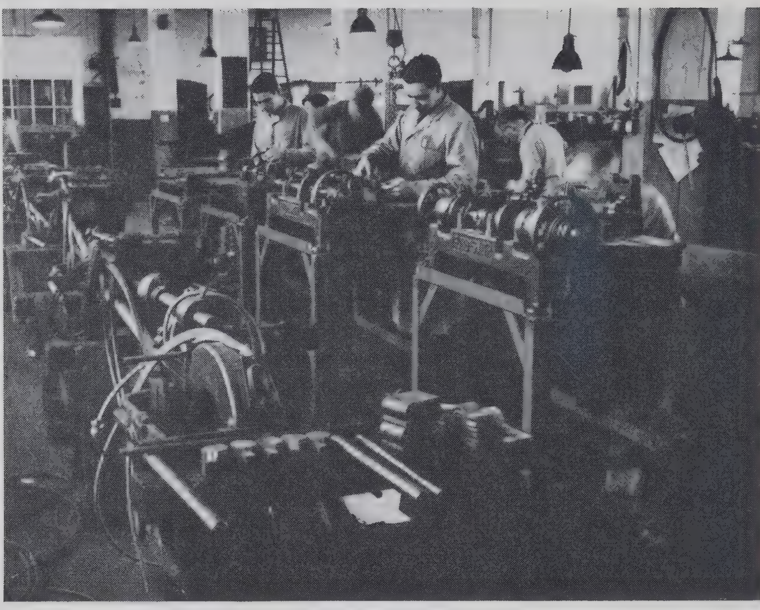

Photo: N.F.B.

A busy machine-tool shop

avoidable in this type of work, the following of a few simple rules of good housekeeping will keep the quantities to a minimum. There is a certain amount of noise to contend with in the operation of the various machines and much of the work must be done while standing. There is, however, no real physical strain placed on these workers, since mechanical aids are used for most of the heavy work.

Workers in this trade are protected by the Unemployment Insurance and Workmen's Compensation Acts, and many firms provide sick leave benefits, holidays with pay, and retirement pension plans.

Hazards

There are a number of occupational hazards such as cuts, burns and eye injuries, that are associated with sharp tools, high-speed machines, and flying metal particles. Tool and die

makers can, however, do much toward eliminating these hazards by adhering to the normal rules of safety in a shop and by wearing steel-toed shoes, proper cover-alls, goggles and other protective clothing.

Earnings

The rate of pay received by a fully qualified journeyman tool and die maker is as good, and in many cases considerably better than, that of most other workers within the industry having a comparable amount of training and requiring similar skills and knowledge.

Apprentices generally receive a percentage of the journeyman's rate with regular increases as they progress in knowledge, ability and experience.

Wage rates vary according to the industry concerned, the individual duties of the worker, and the geographic location of the industry. Examples of the various rates of pay for tool and die makers in selected industries as at October 1957, are given in Appendix B.

ADVANCEMENT

Advancement in this trade is from apprentice to improver, to journeyman. As he gains in experience, a qualified journeyman usually moves to more difficult assignments and additional responsibility. The tool and die maker showing leadership ability and other necessary qualities may become a charge hand, inspector or, eventually, a foreman. Some tool and die makers become estimators, others move into the sales office, and still others go into business for themselves.

A further line of advancement open to qualified workers, is that of tool designer or even tool engineer. Attainment of these positions, however, requires additional schooling and training.

RELATED OCCUPATIONS

The extensive knowledge concerning the whole field of metal working that is required of the tool and die maker, plus the diversity of skills he uses, relates his work, in one way or another, to a number of other occupations found throughout industry. Some of these related occupations are as follows: tool designer, die designer, machinist, and metal-pattern maker.

ORGANIZATIONS

Tool makers and die makers do not have their own union organization. In most cases, they belong to the industrial union covering the plant as a whole or to the International Association of Machinists.

TRENDS

Number in the Occupation

According to the 1951 Census, there were 9,429 males and 14 females engaged in this occupation.

Growth

A comparison of the figures for the total number of tool and die makers recorded in the last three census periods clearly indicates the expansion of this trade. In 1931 there were only 2,851 persons listed in this work; in 1941 there were 7,049 and by 1951 the total had increased to 9,443. This represents an increase of approximately 230% for the full period 1931-51.

Age Distribution

During the last three census periods, the majority of the workers in this trade have been in the 25-54 age group. There has been a slight increase in the percentage of workers in the 55-and-over age group from approximately 10% in 1931 to 13% in 1941 and 14% in 1951. This could, however, be due to the ability of these craftsmen to continue working into old age, and a general shortage of replacements with the necessary skills.

Industrial and Geographic Distribution

The manufacturing industry employed approximately 97% of the total number of tool and die makers recorded in the 1951 Census. Of this number approximately 45% were engaged in the making of iron and steel products and a further 26% in firms concerned with the production of transportation equipment.

Since the major portion of the Canadian manufacturing industry is to be found in the provinces of Ontario and Quebec, it is not surprising that approximately 80% of the total number of tool and die makers recorded in the 1951 Census were located in Ontario and 17% in Quebec.

Outlook

It must be remembered that large scale production in the manufacture of electrical goods, machine tools, instruments, automobiles, aircraft, household appliances and many other products, requires considerable tool design and tool construction before production can get under way. Tool and die makers are therefore key workers in a manufacturing economy. The rapid industrial growth of Canada during and since World War II has led to a general shortage of highly skilled craftsmen and technicians, among whom are the tool and die makers. Long-range prospects are for continued industrial expansion, indicating that the demand for tool and die makers will be maintained. Although there may be short-term periods of recession affecting general employment conditions, these craftsmen are less likely to be affected by slack periods because their specialized skills take years to acquire, and are not readily replaced.

The result of technological change, which was discussed briefly in CANADIAN OCCUPATIONS Monograph No. 8, *Machinist and Machine Operators*[1] may be expected to apply primarily to production workers — those directly concerned with the operation of production machines. Tool and die makers are not production workers in this sense. They, in conjunction with tool engineers and tool designers, are directly involved in creating the technological change that is taking place. It is to be expected, therefore, that tool making and die making will become more complex, requiring greater skill, greater accuracy, and a good understanding of automatic and semi-automatic production processes.

Some aspects of technological change may tend to reduce the demand for tool and die makers. The introduction of automatic die copiers, and a tape controlled machine that is capable of 18 different machining operations without human intervention, are examples of technological change that is taking place within the tool shop. This trend has not, as yet, become widespread, nor is it expected to take place rapidly in the future. The high

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(1) With reference to a report entitled *Probable Effects of Increasing Mechanization in Industry*, presented by the Canadian Labour Congress to the Royal Commission on Canada's Economic Prospects (Queen's Printer, Ottawa, $1.50) and Report No. 2, *Technological Changes and Skilled Manpower* (available on request from the Economics and Research Branch, Department of Labour, Ottawa, Canada).

initial cost of these machines, the existence of much conventional equipment that is still useful, and the increasing complexity of tool and die work indicates a continued demand for competent craftsmen in this field.

FURTHER READING

Department of Labour, Ottawa, CANADIAN OCCUPATIONS Monograph No. 8, *Machinist and Machine Operators*, revised 1958, 10 cents.

The Guidance Centre, Ontario College of Education, Toronto, Monograph, *Tool Maker*, revised 1955, 13 cents.

U.S. Department of Labour, *Occupational Outlook Handbook*, revised 1957, Chapter on Machining Occupations includes tool and die makers.

National Association of Manufacturers, 2 East 48th Street, New York 17, N.Y., *Your Opportunities in Industry as a Technician*, 1957.

Michigan Employment Security Commission, Detroit, Michigan, Occupational Guide No. 32, *Tool and Die Makers*, revised 1958.

General Motors, Oshawa, Ontario, booklet *Can I Be A Craftsman?*, undated.

FILMSTRIP

The Department of Labour has collaborated with the National Film Board in producing the filmstrip *Machine Shop Occupations*. It describes, with authentic pictures, the nature of the work, training, working conditions, employment outlook, and other aspects of the various machining occupations, including tool and die makers.

APPENDIX A

The following list contains information pertaining to a number of Vocational Correspondence Courses that might be of some value to persons intending a career as a tool and die maker.

The number preceding the course title is the catalogue number and should be quoted along with the course title when inquiring to the proper provincial agency for further information.

44. Blueprint Reading, N.S. — 20 Lessons — Fee $14. (1943).
Prerequisite — Grade IX or Elementary Mathematics or equivalent.
Prepared for — Tradesmen (Metal Trades).
Content — This course is designed to teach mechanics how to read blueprints.

77. Mathematics, Advanced Shop, N.S. — 20 Lessons — Fee $14. (1913).
Prerequisite — Grade IX or Elementary Mathematics or equivalent.
Prepared for — Tradesmen.
Content — This is a practical course teaching the application of geometry, graphics and trigonometry to shop practice. It is equivalent to Grade XI mathematics with the exception of the geometry portion.

The above courses may be obtained from The Supervisor, Correspondence Study Branch, Box 221, Halifax, Nova Scotia.

42. Blueprint Reading, Quebec — 15 Lessons — Fee $10. (1954).
Prerequisite — Grade IX or equivalent.
Prepared for — Tradesmen and General Public.
Content — This course is designed to teach machinists or those interested in mechanics to read blueprints.

45. Dimensional Sketching, Quebec — 15 Lessons — Fee $12. (1949).
Textbook — "Croquis coté" G. Berthiaume. (1949).
Prerequisite — Grade IX or equivalent.
Prepared for — Tradesmen.
Content — Covers free hand industrial drawing and sketching.

47. Machine Parts, Quebec — 10 Lessons — Fee $7.50 (1948).
Textbook — "Organnes de machines" V. Trudeau.
Prerequisite — Grade IX or equivalent.
Prepared for — Students in drafting, storekeepers and tradesmen.
Content — The purpose of this course is to acquaint people with the various parts and components used in assembling the parts of machines used in industry.

The above courses are published in French and are available from The Director Correspondence Course Bureau, 506 St. Catherine Street East, Montreal 24, Quebec.

68. Machine Shop Practice 1, Ontario — 20 Lessons — Fee $10. (1954).
Prerequisite — Grade VIII Mathematics.
Prepared for — Tradesmen.
Content — This course on bench work covers files, filing, polishing layout tools and their use, drilling, tapping, grinding, standard threads, soldering and brazing, riveting, hammer welds, elementary heat treating, hardening and tempering.

The above course is available from The Director, Correspondence Courses Branch, Department of Education, Toronto 5, Ontario.

APPENDIX B

Earnings of Tool and Die Makers in Selected Industries as at October 1957

Industry and Location	Wage Rate per Hour (Time Work) *Average*	*Predominant Range*
Agricultural Implements	2.13	1.96 — 2.21
Heating and Cooking Apparatus		
Canada	1.97	—
Quebec	1.71	1.39 — 1.98
Montreal	1.76	1.50 — 1.98
Ontario	2.04	1.80 — 2.23
Toronto	2.17	2.11 — 2.23
Household, Office and Store Machinery		
Canada	2.03	—
Quebec	1.83	1.65 — 2.03
Montreal	1.92	1.65 — 2.03
Ontario	2.11	1.90 — 2.40
Toronto	2.17	2.00 — 2.40
Machine Tools		
Canada	2.14	—
Ontario	2.15	1.90 — 2.36
Industrial Machinery		
Canada	2.00	—
Quebec	1.76	1.52 — 2.03
Montreal	1.82	1.63 — 2.03
Ontario	2.06	1.87 — 2.27
Toronto	2.02	1.87 — 2.18
British Columbia	2.33	—
Sheet Metal Products		
Canada	1.99	—
Quebec	1.93	1.70 — 2.06
Montreal	2.05	1.98 — 2.18
Ontario	2.00	1.82 — 2.20
Toronto	2.01	1.90 — 2.10
Aircraft and Parts		
Canada	2.13	—
Quebec	2.11	2.09 — 2.19
Ontario	2.18	2.00 — 2.35
Toronto	2.21	2.00 — 2.35

Industry and Location	Wage Rate per Hour (Time Work) Average	Predominant Range
Motor Vehicles		
Ontario	2.30	2.21 — 2.39
Motor Vehicle Parts and Accessories		
Ontario	2.21	1.92 — 2.41
Brass and Copper Products		
Canada	1.97	—
Quebec	1.98	1.72 — 2.24
Ontario	2.00	1.82 — 2.14
Heavy Electrical Machinery and Equipment		
Canada	2.19	—
Quebec	2.09	1.86 — 2.31
Montreal	2.17	1.93 — 2.31
Ontario	2.19	2.07 — 2.38
Toronto	2.16	2.06 — 2.31
Radio, Television and other Electronic Equipment (Toolmaker)		
Canada	2.11	—
Quebec (Montreal Only)	2.17	1.97 — 2.35
Ontario	2.07	1.85 — 2.34
Toronto	2.03	1.50 — 2.31
Refrigerators, Vacuum Cleaners and Miscellaneous Electrical Products		
Canada	2.13	—
Quebec	2.10	1.81 — 2.27
Montreal	2.14	1.99 — 2.27
Ontario	2.15	1.90 — 2.39
Toronto	2.17	1.88 — 2.39
Wage Rates for Selected Maintenance Trades in Manufacturing		
Quebec (Montreal Only)	2.05	1.81 — 2.22
Ontario	—	—
Hamilton	2.18	2.07 — 2.28
London	2.00	1.79 — 2.25
St. Catharines	2.28	2.13 — 2.40
Toronto	2.15	1.95 — 2.35
Windsor	2.26	2.05 — 2.39
British Columbia	—	—
Vancouver	2.32	—

Source: *Wage Rates and Hours of Labour — 1957*
Economics and Research Branch,
Department of Labour, Ottawa, Canada.

LOCAL INFORMATION

LOCAL INFORMATION

CANADIAN OCCUPATIONS FILMSTRIPS

The Department of Labour has prepared, to date, the following occupational filmstrips in collaboration with the National Film Board. A manual has been prepared as an accompaniment to each filmstrip. These may be purchased from the National Film Board, Box 6100, Montreal, or from any one of its regional offices.

Plumber, Pipefitter and Steamfitter
Careers in the Engineering Profession
The Social Worker
Technical Occupations in Radio and Electronics
Bricklayer and Stone-Mason
Printing Trades
Careers in Natural Science
Careers in Home Economics
Motor Vehicle Mechanic
Mining Occupations
Draughtsman
Careers in Construction
Machine Shop Occupations
Careers in Meteorology
Medical Laboratory Technologist (in colour)
Teacher (in colour)

DEPARTMENT OF LABOUR

Economics and Research Branch

CANADA, 1959

Price 10 cent Cat. No. L 43-1859
Available from the Queen's Printer
Ottawa, Canada

QUEEN'S PRINTER AND CONTROLLER OF STATIONERY
OTTAWA

CANADIAN OCCUPATIONS

★

RAILWAY CAREERS

★

MONOGRAPH 19

DEPARTMENT OF LABOUR, OTTAWA

CANADIAN OCCUPATIONS

★

RAILWAY CAREERS

MONOGRAPH 19

HON. MILTON F. GREGG, V.C., MINISTER

A. H. BROWN, DEPUTY MINISTER

DEPARTMENT OF LABOUR, OTTAWA

FOREWORD

During recent years there has been a steadily increasing demand for up-to-date information on occupations.

This demand comes from youth faced with the need of choosing an occupation and of selecting the type of training required; from parents, teachers and other counsellors; from workers shifting to other occupations; from employment service officers; from directors of personnel and union officials, and from other quarters.

This series of monographs and an accompanying series of pamphlets, the latter containing similar information in a condensed form, are attempts to meet this demand.

These publications represent an expansion of an earlier series issued by the Department of Veterans Affairs to assist members of the armed forces returning to civilian life following the end of the war. These current series, designed for general use, cover a wide range of occupations, including professions. They indicate, among other things, the nature of the occupations or group of occupations, entrance and training requirements, working conditions and opportunities in each.

This monograph, as was the case in those which preceded it, was prepared by the research staff in the Occupational Analysis Section. Basic material for this monograph was supplied by officials of the Canadian National Railways and the Canadian Pacific Railway. The assistance of these officials and of the major organizations representing railway employees, together with the assistance of the Unemployment Insurance Commission, the Vocational Training Branch of the Department of Labour and the Dominion Bureau of Statistics is gratefully acknowledged.

DIRECTOR,
Economics and Research Branch,
Department of Labour.

June, 1954.

TABLE OF CONTENTS

			Page
Chapter	I	The Canadian Railway Industry..........	5
Chapter	II	Clerical Workers......................	12
Chapter	III	Operations............................	15
Chapter	IV	Communications........................	33
Chapter	V	Express Department....................	38
Chapter	VI	Hotel Systems.........................	41
Chapter	VII	Sleeping, Dining and Parlour Car Department......................	44
Chapter	VIII	Applying for Employment...............	47
Chapter	IX	Trends................................	52
Chapter	X	Statistical Data......................	53

CHAPTER I

THE CANADIAN RAILWAY INDUSTRY

Photo: C.N.R.

A freight brakeman gives the "high-ball"

Railroading in Canada today is a far cry from what it was in the days when the first steam engine was introduced, when our forefathers began the gigantic task of welding the far-flung regions of this great country together, a task in which railways were an essential and major factor. The growth of Canada's

railways has paralleled the growth of Canada from colony to nation. Today the railways continue to contribute in ever-increasing measure to the country's economic expansion.

From a handful of pioneer workers and a few miles of track, the growth of the railways has been remarkable. Today the Canadian National and the Canadian Pacific alone operate more than forty-one thousand miles of track, which include 1,850 miles in the United States, and more than 187,000 men and women are required to keep these mighty transportation systems functioning.

In May 1953, there were in all 203,396 employees on the railways of Canada. The total payroll for the month was $57 million.

The total mileage of all the roads was roughly 43,000 miles and in 1951 they operated totals of nearly eight million freight train miles and over 3,800,000 passenger train miles. They owned 177,000 freight cars, 6,500 passenger cars and 4,850 locomotives.

Railroading in Canada is almost a way of life for many Canadian families. In many families generation after generation have made it their life's work.

To the majority of people the train is the railway, and the conductors, trainmen, locomotive engineers, firemen and ticket clerks are the railroaders. But there are thousands behind the scenes, the agents and despatchers, traffic controllers, men in the shops, maintenance crews, and men and women in the offices all over the country and in parts of the United States. All these form part of a system sometimes appropriately called "the arteries of the nation", through which the life blood of commerce flows.

The railways of Canada are the largest employers of industrial labour and the largest purchasers of industrial materials in Canada.

Railway power is dependent on manpower. Because the railways are usually growing, new workers are needed almost every day to fill gaps in every department. The railways of Canada operate Hotels, Communications (Telephones and

Telegraphs) and Express Service. These multiple activities offer a great variety of jobs. There are positions open to persons at every educational level.

The Operating group of departments of the railroad is one of the most fascinating, because, among others, it includes all those actively engaged in the running of the trains; it contains approximately eighty-five per cent of the employees. Under the heading of "operating" there are grouped three major departments: transportation, motive power and car equipment (or, as it is also called, mechanical) and engineering. The *transportation* department is responsible for all the details relating to the actual movement of the trains. The *mechanical* department maintains and ensures the serviceability of all rolling stock. The *engineering* department fulfills the important task of maintaining the way and structures.

The remaining departments of the railway, each in itself important, include the following: *Traffic*, *Accounting*, *Finance*, *Purchasing and Stores*, *Research and Development*, *Colonization and Agriculture*.

The railroad may be likened to a factory. The operating department is the production end, traffic represents the sales, while the functions and importance of the accounting and financial departments are apparent. *Communications* and *express* are supplementary operations of the main plant, as are also the *hotel systems* and the *sleeping* and *dining car services*.

A great variety of workers is necessary to carry out the many activities involved in railroading. The person whose interest is in mathematics and bookkeeping can find a place in the accounting or the financial section. One who is mechanically inclined, can enter one of the many trades as an apprentice and, after a period of training, graduate as a skilled tradesman. For those whose choice is catering, there is opportunity in the sleeping and dining car department, in a kitchen on wheels, or in one of the many hotels.

A railway is never complete; something new is always being added. It may be track, equipment, freight sheds, hotels, or stations. Year after year the process of expansion and improvement goes on. There has never been a time when research on the

railroads was greater or more effective than at present. As materials become available and difficulties are overcome, the railroads will have more powerful and efficient locomotives, improved passenger and freight cars, better signals and communication equipment, and many other improvements.

The change over from steam power to diesel-electric power is a major revolution in itself. Since spare parts for the latter are supplied by the manufacturers, much of the work formerly done by tradesmen in the repair shops will be progressively eliminated as steam locomotives disappear from the scene.

The record of Canadian railways during war and peace demonstrates that they are of vital importance to the country's security and economic growth. The expansion of Canada's economy during the twentieth century, and especially in the last decade, has been rapid. New rail lines have become necessary. The untold wealth of the North is no longer a mere potentiality, and its development is steadily gaining momentum.

In the following account, the railroad occupations have been grouped according to the major branches into which the work of the industry is divided. An exception to this grouping is that of clerical work, which is common to all departments, and is accordingly dealt with by itself in Chapter II.

BRANCHES OF THE INDUSTRY

The *Operations* branch is the one best known to the public. This deals with the actual running of trains, maintenance work, engineering work, shop work, repairs and related activities. As previously noted it employs the majority of railway workers.

The *Communications* branch deals with the use of telegraphy and allied means of instant communication, for railroad purposes and as a service to the public.

The *Express* branch handles goods in quick transit by passenger train, and the collection and delivery of such goods.

The *Traffic* branch is responsible for the solicitation of freight and passenger traffic and is therefore in more direct contact with the public than most of the other branches of the industry. It is also responsible for the preparation, in co-operation with the Operations branch, of time-tables and tariffs, and performs numerous miscellaneous functions. The work is largely clerical.

The *Accounting* and *Finance* branches perform the duties indicated by their names. The work is largely clerical.

Among the little-known activities of the railways are those coming under *Research and Development.*

These have to do with the development of the industrial and natural resources of the country, with the inspection of all materials purchased by the railway (in the case of the C.N.R.), with economic studies of any phase of railway activity, actual or prospective. The department performs work of this kind for other departments of the railway as well as initiating research projects of its own. For example, it provides metallurgical supervision for the mechanical department. An important activity of the development section is assistance to industry in locating

Photo: C.N.R.

Testing materials in laboratory of Research and Development Department

suitable sites for new plants. The Canadian Pacific Railway has separate Research and Industrial Development units.

Since much of the work in research and development requires professional training, a number of graduates in science, and in civil, mechanical and electrical engineering, as well as certain other kinds of professional personnel, are employed in this department.

TRANSFERABILITY

Young people starting out in business sometimes find that they are not adjusted to their first position for numerous reasons. Such being the case, newcomers to the railway will sometimes seek to change their department to another which provides work that seems interesting or more suited to their aptitudes. What is the outlook for the newcomer who feels maladjusted to his first railway duties?

It must be noted that persons in junior positions in most branches of the railways do not necessarily remain in one branch. There is a high degree of transferability in many of the positions in the lower ranks, and promotion is not limited to employees within a specific branch. This is especially true of clerical workers. Seniority in a group is naturally a factor in all promotions. Classified tradesmen find it inadvisable to transfer because this would discount five years' apprenticeship. Very few senior positions are filled from any source other than the railroad's own staff.

Transfers can be arranged if the following conditions apply:

1. The employee's age and salary are not in excess of those attached to a position which becomes vacant in another department, provided that he has the other qualifications necessary for proper performance of the job.

2. The vacancy cannot be filled by an employee in the department concerned.

3. If an employee is laid off, and is willing to accept a position in another department that is of a temporary nature, and is in accordance with his qualifications. The same would apply if he were willing to accept a transfer to a

permanent position but with the understanding that he would renounce any seniority rights he had in his former department.

4. If the applicant has pursued and completed educational courses in business college or university and has acquired abilities that cannot be used to best advantage in his own department, provided of course, a vacancy exists which cannot be filled from within the other department.

No discussion of the railway industry in Canada would be complete without mention of the railway unions. A large majority of Canadian railway employees are members of one of four "operating" and many "non-operating" trade unions. With one exception the names of the unions indicate the kind of work performed, i.e. electrical workers, machinists, firemen, engineers, conductors, etc. In the case of the C.P.R. three operating unions cover all the "running trades".

The procedures to be followed in conducting collective bargaining negotiations are outlined in the Industrial Relations and Disputes Investigation Act, 1948, which is administered by the federal Minister of Labour. This Act provides for conciliation of matters in dispute between management and labour and ensures the safeguarding of the rights of both sides. Since over fifty per cent of the cost of running any railway is represented by wages, it is obvious that negotiations respecting pay and other matters coming under industrial relations are of paramount importance.

So far, we have been taking an introductory look at the railroads, surveying the whole panorama of their activities. We will, in the following chapters, examine certain groups of occupations in greater detail.

CHAPTER II

CLERICAL WORKERS

The following is a general outline of clerical organization in departments employing a considerable number in this occupational group.

The entry occupations for clerical workers are as follows:

a) **Accounting Department:** Messengers, office boys, typists, stenographers, calculating machine operators, key punch operators.

b) **Finance Department:** Junior clerk is typical entry occupation. New workers are expected to train for more advanced work.

c) **Freight and Passenger Traffic Departments:** Junior clerk, stenographer (male or female).

d) **Operating Department:** Car checker, assistant agent, call boy, messenger, office boy, stenographer (male or female).

e) **Sleeping, Dining and Parlour Car Department:** Junior clerk, typist, stenographer.

f) **Communications Department:** Messenger, stenographer, routing aide, automatic operator, telephone operator.

g) **Express Department:** Office boy, clerk, stenographer.

h) **Hotel Department:** Hotel clerk, dining room cashier, typist.

i) **Purchases and Stores:** Junior clerk, clerk, stenographer.

Normal advancement is dependent on group seniority and upon vacancies arising through retirements, deaths, and promotions.

Clerical positions, according to departments, may be regarded as falling generally within the following categories:

Accounting: Office boy or girl, sorter, junior clerk, key punch operator (female), comptometer operator (female), intermediate clerk, senior clerk, accountant, chief clerk, travelling auditor, leading to higher executive positions within the department.

Finance: Junior clerk, advice typist, bookkeeping machine operator, clerk handling remittances, files and financial papers, leading to assistant chief clerk, chief clerk and to executive duties within the department.

Freight Traffic: Junior clerk, file clerk, junior stenographer, senior stenographer, secretary, intermediate clerk, rate clerk, senior clerk, assistant chief clerk, chief clerk, leading to assistant chief of bureau, chief of bureau, assistant general freight agent, general freight agent, assistant freight traffic manager, freight traffic manager.

Passenger Traffic: Office boys, junior clerks (male or female), stenographers, clerk stenographers, ticket clerks, rate clerks, timetable compilers, senior clerks, chief clerks, leading to ticket agents, traffic representatives or solicitors, city ticket or passenger agents, general agents, officers in charge of offices or branches.

Photo: C.N.R.

A ticket clerk

The following remarks apply to the clerical organization:

Junior staff are trained on the job under the supervision of senior clerks. A probationary period must be satisfactorily completed before permanent appointment.

Working conditions include a five-day, forty-hour week. Juniors are encouraged to attend night school courses and to develop a comprehensive interest in railway work. Women are especially suitable for certain types of work involving dealings with the public.

In addition, there are the following clerical opportunities in the Operating Department: *Car checkers*, whose outdoor work may lead to the promotional ladder of yard clerk, train clerk, chief clerk to the general yardmaster, and possibly an executive position. *Assistant agents* in smaller stations may become telegraphers, agent-telegraphers, agents, train despatchers, and possibly rise from this to much higher levels. *Call boys* at round houses or yard offices may follow a clearcut path to clerical positions, or may transfer to train crew or shop maintenance.

In *regional head offices* and in *divisional and district offices* male stenographers may find an opportunity of continuing a traditional trend on the railway by becoming secretaries to executives, and eventually themselves becoming executives. There are about thirteen hundred male stenographers in the service of Canadian railways. Male stenographers have long been preferred by railroad executives, many of whom have to travel a great deal.

Typing and stenographic pools are not a usual feature of railway offices; stenographers and clerks are spread throughout the establishment.

Promotion in the clerical field is usually more rapid in the first two or three years; for the next eight or ten it is at a slower pace. Willingness to move from one point to another is important, and promotion frequently involves a change of location.

In freight sheds and yard offices afternoon (four to twelve) or night work (mid-night to eight a.m.) is necessary, the preferred shifts being allotted by seniority.

There is no sharp demarcation line between clerical and other staffs. At smaller points operating and maintenance men are in frequent contact with office workers.

CHAPTER III

OPERATIONS

The operating department of a Canadian railway is perhaps more in the public eye than are the other departments. Everyone knows that passengers and freight are carried; that engines and cars must be serviced and maintained in running order; that roadbeds, embankments, tracks, bridges, culverts, crossings and stations must be kept in good condition.

The ticket seller and the station agent, the engineer and the fireman, the brakeman and the conductor are all familiar figures in Canadian life. Most people know that telegraphers are necessary to the running of trains; business people have dealings with freight agents; in larger centres baggagemen and redcaps are at the service of the public, and railway police are to be seen. There are, however, important groups of railway workers whose function is not commonly known, and this chapter will give some account of them.

Since those engaged in communications work and in the express service are considered as belonging to those departments, even though they may be, in smaller centres, also doing some operations work, they are dealt with in separate chapters. The same applies to clerical staff.

Entry

Entry into the operating department is generally into junior jobs leading to a more definite occupation. Thus those intending to follow a skilled trade are apprenticed; those intending to become locomotive engineers learn on the job as firemen; would-be conductors start as trainmen. In the C.P.R. service firemen are generally appointed by promotion from Engine Wiper, a routine job. In other occupations the work is learned on the job with progress later to foreman and upward. Some details of these entry jobs follow:

Engine and train crew callers (call boys)

Minimum age is sixteen. At least two years of high school education are required. Duties are to notify engine and train

Photo: C.N.R.

A passenger department representative helps to plan a trip

crews, at their homes or elsewhere, of the time and train for which their services are needed.

This work leads to clerical or mechanical jobs, or transfer to better paid and more responsible duties.

Car Checkers

Age group is 17-21; education two years high school. The work is chiefly outdoors, recording on proper forms car number, owner's initials and other details of freight cars in sidings at terminals. This work speeds the movement of freight.

Car checking leads to promotion to clerical positions, or to transfer to better occupations, sometimes in other departments.

Miscellaneous

There are a number of jobs in which men of suitable age, education and physique may find initial employment. These include the following:

Freight truckers, handling freight on trucks from cars to sheds, around the sheds, or from sheds to cars. Promotion may be to checker or foreman.

Constables perform general police work. Promotion is to sergeant and higher ranks.

Motormen-conductors operate electric trains.

Helpers and labourers in many lines of work. These may advance to foremen.

Important groups which employ many labourers are:

Section and Bridge and Building Gangs. Both are under the jurisdiction of the Division Engineer. A division is a section of the railroad under the jurisdiction of a Superintendent.

Section gangs, engaged in track maintenance and repair, are organized by sections of subdivisions of each division. A *Roadmaster* is in charge of each subdivision. The Roadmaster is one of the most important cogs in the railway organization. He is on call twenty-four hours a day. He is responsible for the work

done and the enforcement of rules and regulations on all the sections in his assigned territory. He also plans, orders, and is in charge of work performed by work trains, spreaders (snow and ballast), flangers and snow plows. Acting under his immediate supervision are the *Assistant Roadmasters* who aid him in the performance of his duties. Directly following, and responsible for the maintenance of the roadbed and the right of way on a section of the subdivision are the *Section Foremen*. The foreman must be practical, experienced and trustworthy. He must be able to read and understand rules, timetables and written orders, and to keep time-sheets for workers, and records of material used. With his gang, composed of labourers of good physique, the foreman must carry out all necessary work, and in addition watch passing trains for easily visible defects such as flat wheels, "hot-boxes", or dragging brakebeams. Should such defects be seen, he should signal a "stop"; otherwise he gives a "clear signal". He must personally inspect all parts of his section periodically. He must make special inspections when storms, freshets or slides may cause danger. He must check track levels, keep the track in good line, report defects in bridges and culverts, and see that the section is in good condition.

Section men unload ballast, change ties and rails, remove weeds, and keep the right of way clean. They do heavy manual work. They are promoted on a seniority basis. This work may be more or less regular according to seniority.

Bridge and Building workers are responsible for the inspection, renewal, repair and safety of all bridges, trestles, culverts, snowsheds, wharves, platforms, water supply, coal and sand-handling plants, ash-pits, turn-tables, and indeed all buildings.

Bridge and building workers are headed by *Bridge and Building Masters*, who have charge of bridge and building forces and of other labourers and mechanics employed by the railway on the erection, renewal and repair of bridges, buildings and other structures in their territories. B and B Masters select *foremen* and assign them to their duties, enforce maintenance of way rules and instructions and operating rules, and see that all employees under them know and understand rules concerning them and their work.

In addition, B and B Masters are responsible for immediate repairs to unsafe structures, and must make reports on these.

B and B Masters must look after important repairs to bridges and other structures resulting from damage through mishap or natural forces; they supervise the work of contractors, check performance against specifications and are on call night and day in case of emergency.

A *B and B Foreman* requires the same qualities as does a section foreman. He must see that the duties assigned him are promptly performed. His duties with regard to rules are similar to those of the section foreman. He requisitions tools and supplies, sees that boarding cars are clean and sanitary, and is responsible for the work of his men.

A *B and B gang* may, according to the nature of the job, have as its component any or all of the following tradesmen and their helpers; carpenters, bridgemen (rough carpenters), cabinet makers, painters, tinsmiths, plumbers, and pipe fitters. Promotions are made on a seniority basis.

Signals Department — This branch of the Maintenance of Way Department is also responsible to the Division Engineer. This is a more technical branch of the service than either of the two just mentioned. The signals department is responsible for such work as construction and maintenance of interlocking plants, train order boards, automatic signals and automatic crossing protection. New employees are hired as helpers and are trained on the job to be signal maintainers. Maintainers obtain their job on a seniority basis. *Signal supervisors* come from the ranks of the maintainers.

The "Running Trades"

Individuals entering the service in the running trade groups commence as follows:

(a) Yardmen
(b) Trainmen
(c) Firemen

The preferred age range for entry is from 21 to 30 years of age although, in some circumstances, beginners are admitted at the age of 18.

Applicants must have 20/20 vision in both eyes without glasses and be physically sound.

Photo: C.N.R.

Stock clerk fills a requisition for parts

The duties of the members of these trades and their promotional channels are as follows:

(a) *Yard Helpers* or *Yardmen* as they are commonly called, work under the jurisdiction of a *Yard Foreman* who is under the supervision of a *Yardmaster* and is responsible for the making up of trains, switching of inbound trains, transfer of cars between the various yards, setting up of loaded cars and the removal of empty cars from industrial tracks and freight sheds. Generally speaking, a yardman transmits signals for switching operations, couples and uncouples cars and turns switches for such moves, except where switchtenders are employed. Yardmen are required to qualify as yard foremen by passing examinations in the operating rules, (in C.N.R. service after they have worked three years as yardmen). *Yard Foremen* can obtain promotion to positions as *Assistant Yard Masters*, *Yard Masters* and *General Yard Masters*.

(b) *Trainmen* work under the jurisdiction of train conductors. Trainmen newly employed are required to satisfactorily complete a preliminary examination in the operating rules and after suitable instruction by an Officer of the Company are permitted to undertake such work as they may be entitled to in accordance with their seniority standing. The duties consist of setting cars off their train, picking up cars en route and cutting these into their train by making the necessary couplings, observing signals and relaying signal indications to the conductor, and watching performance of the train while in motion to observe any defects in the equipment.

To remain in the service, a Trainman is required to pass, over a three-year period, subsequent examinations pertaining to operating and mechanical matters.

To qualify for promotion to Conductor, a Trainman must pass a further examination in the operating rules.

(c) Upon entering the service *Locomotive Firemen* are in some cases limited to yard service* until they qualify to handle hand- and stoker-fired steam engines and diesel-electric engines. Usually they qualify within six months for main-line freight service. After they attain proficiency on all types of locomotives

*Newly appointed locomotive firemen are not restricted to yard service by the C.P.R.

in freight service they must then qualify for passenger service and must become familiar with any part of the line over which they may be required to operate. The duties of a *Fireman* are to maintain sufficient steam pressure in boilers, to call signal indications to the engineer, and become sufficiently proficient in engine operation to qualify for promotion to the position of *Locomotive Engineer* by progressive stages within a three-year period from the date of employment. Like trainmen, firemen are required to satisfactorily complete a preliminary examination in the operating rules. On-the-ground instruction is given by a *Mechanical Officer*, and several trial trips are made in freight service. They are then permitted to exercise their seniority in performing such work as may be available.

To remain in the service a fireman is also required to pass, over a three-year period, subsequent examinations pertaining to operating and mechanical matters.

To qualify for promotion to locomotive engineer, he must pass a further examination in the operating rules.

The second man of the engine crew on a diesel locomotive is called a helper. The duties of a helper on a diesel locomotive are less arduous than those of a fireman on a steam locomotive. Aside from the operating factors, such as the calling of signal indications, the helper only makes periodic readings of gauges to make certain all units are functioning properly. Helpers are not required, nor are they qualified, to make any adjustments or repairs to the engines of these locomotives.

Repair work is performed by *Diesel Maintainers*. *Rule Instructors*, *Road Foremen of Engines* and *Master Mechanics* are promoted from the ranks of locomotive engineers. Rule Instructors may also be promoted from Conductor.

Telegraph Operators

These operators have an important part in actual operations, and their duties often vary accordingly.

The railway does not usually undertake to teach telegraphy and, when employed, *Telegraphers* must be able to receive and transmit twenty-five words per minute, and must pass an examination in the operating rules. Assistants and clerks at smaller

stations frequently learn telegraphy under the guidance of an agent or telegrapher, and, unless they do so, their promotional field is restricted to clerical and manual positions in their own seniority group.

In addition to receiving and transitting messages, train orders, etc., telegraphers are required to assist *Agents* with the clerical work, sell tickets and do the manual work in the handling of freight and express.

Telegraphers are promoted to positions as agents in accordance with their seniority. No examinations are required to be passed to qualify as agent. Telegraphers may also be promoted to a position as *Despatcher*, but first qualify by "sitting in" with the despatchers, and must be approved by the despatcher handling the territory over which the new appointee will despatch trains*. *Chief Despatchers* are promoted from the ranks of despatchers.

Spare Operators are used to relieve regularly assigned operators who have to be off duty for any reason. It is therefore in the interest of the spare operator to qualify in all phases of station work, as he may be called upon to relieve at any station on the division. Spare operators must be available to accept all spare and relief work.

APPRENTICESHIP

Training

A progressive program is laid down to provide the required training for the following trades:

Machinist	Carman
Boilermaker	Upholsterer
Blacksmith	Pattern Maker
Pipe Fitter (Steam Fitter C.P.R.)	Moulder
Electrician	Wood Machinist
Sheet Metal Worker	Painter

The apprentice works in the regular departments of the shop and is engaged in regular production work. In the C.N.R. service he attends class two hours per week, in the C.P.R. 4 hours per week, for three years, and is taught mathematics, mechanical

*This is not necessarily the case on the Canadian Pacific system.

drawing and trade theory. Examinations in these subjects are held annually. Instruction is also given on safety and accident prevention, and a limited number of apprentices are given first-aid training.

Photo: C.N.R.

Class receiving instruction

Principal Duties

To serve a five year period of apprentice training in one of the shop trades and to follow one of the programs outlined on pp. 26-31. Upon graduation, the apprentice is issued a certificate which qualifies him to practise his trade.

Working Conditions

The apprentice will work in the shops under the supervision of the Shop Instructor and Foreman (C.N.R.) or Foreman

(C.P.R.). It is inside work for the most part. He may be required to do shift work, and is moved from department to department of the shop to acquire general training. The apprentice is allowed vacations with pay according to agreement with the Shop Craft Employees' Organization; he is entitled to railway transportation privileges after six months service. He must provide, at his own expense, the necessary tools of the trade and drafting instruments.

Physical Requirements

Applicants must be between the ages of sixteen and twenty-one, of normal physique and strength, and must pass a physical examination by the railway doctor. Manual dexterity is essential.

Academic Requirements

High school entrance is the minimum educational requirement; candidates having two or more years high school are preferred. The applicant must submit a report with regard to his school standing and must pass the railway's educational entrance examination which stresses mathematics. He must give evidence of manual dexterity and mechanical aptitude while undergoing his pre-employment screening.

Advancement

On the completion of their apprenticeship, apprentices are credited with two year's seniority, and it has been possible for several years now to provide work for all the apprentices who have graduated. Promotions are governed by seniority where qualifications are sufficient. Qualities of leadership, in addition to trade skill and other qualifications, will lead to positions of *Assistant Foreman*, *Foreman*, *General Foreman*, *Shop Superintendent*, or "*Works Manager*".

All present officers of the Motive Power and Car Equipment Department of one of the major railroads were apprentices at one time. The management of this department is always on the lookout for men who are bright and show leadership capacity. As mentioned elsewhere in this booklet, apprentices are encourag-

ed, after serving half their apprenticeship, to take leave of absence to attend university. A number of engineers, civil, mechanical and electrical, got their initial start towards professional training in this way. While in college they earned money to defray their tuition expenses by taking summer employment at their trade which was counted as part of the apprenticeship period with the railway.

Shop Training

Following is a list of the various machines, tasks and processes to which apprentices are assigned during the course of their training:

Canadian National	**Canadian Pacific**
Machinist Apprentice — Machine Shop	
Drill Press	Drills, saws and minor jobs
Slotters	Shapers and Planers
Shapers	Slotters
Planers	Millers
Grinding Machines	Lathes
Milling Machines	Boring Mills
Boring Machines	Grinders
Fitting	
Bench work	Marking table
Air Brake	Motion bench work
Tool Room	Crosshead and piston bench work
	Fitting cylinders and frames
Welding	
Electric	Burning and Welding
Oxy-Acetylene	Shoes and wedges
	Motion
Erecting and Fitting	
General Erecting Shop	Valve setting
General Diesel Repairs	General Fitting (Steam and Diesel)
Running Repairs	
Roundhouse	General air brake work
Diesel Maintenance	
Upholsterer Apprentice	
Spring Setting and Building Up	Dismantling
Sewing Machine Work	Sash curtain mounting
Linoleum and Rubber Work	Laying rubber, linoleum and carpet
Material Lay-out and Cutting	Seats and backs, ripping and recovering
Blinds, Curtains and Drapes	Upholstering seats and backs
General Upholstering	Rolls, sofas and backs
	Covering sofas
	Springing, covering and upholstering chairs
	General upholstering
	Laying out and cutting

Canadian National

Carman Apprentice

Trucks
Draft Gears
Underframes
Body Work
Air Brakes
Cabinet Work
Mill Machinery
Electric Welding
Oxy-Acetylene Welding
Laying Out
Punch and Shear Machine
Running Repairs (Out-stations)
Car Inspection

Canadian Pacific

Freight Car Shop

Roofs, bodies, refrigeration cars
Underframes and trucks, welding

Passenger Car Shops

Roofs and bodies, Floors
Planing Mill, Truck shop
Car brake and foundation brake gear
Cabinet shop (new work)
Interior finish (passenger cars)

Locomotive Shop

Locomotive Carpenter shop

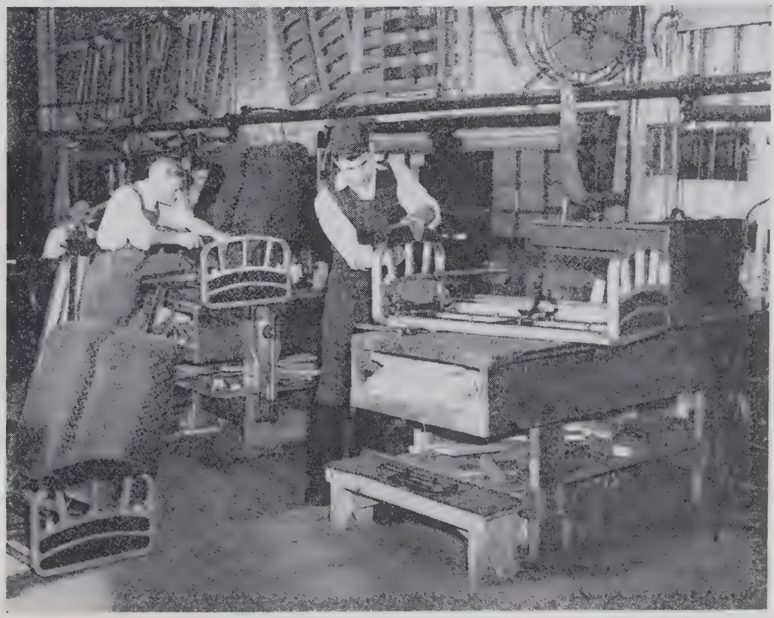

Photo: C.N.R.

Upholsterers in the car shop

Moulder Apprentice

Canadian National	Canadian Pacific
Mixing	Coremaking
Core Making	Operating small moulding machine
Moulding Machine	Operating big moulding machine
Bench Moulding	Burning and welding
Cupola Operation	Operating cupola and furnace
Advanced Core Making	General moulding
Electric Welding	
Oxy-Acetylene Welding	
General Floor Moulding	

Patternmaker Apprentice

Canadian National	Canadian Pacific
Pattern Storage	Helping small pattern repair
Pattern Finishing	Foundry and mould experience
General Bench Work	Work with patternmaker
Small Pattern Work	Second class work
Turning	First class work
General Wood Working Machine	
Large Pattern Work	
Metal Patterns	

Boilermaker Apprentice*

Canadian National	Canadian Pacific
Light Sheet Steel Work	Heating rivets
Tank Work	Tube plant
Tender Construction and Repairs	Setting and rolling flues
Ashpan Construction and Repairs	Tank repairs, ashpans and sheet iron work
Staybolt Work	Stay bolts
Tubing	Burning
General Boiler Repairs	General Boiler Work
Electric Welding	Welding
Oxy-Acetylene Welding	Testing boilers and pressure
Laying Out	Bessels
Running Repairs – Roundhouse	Layout and flanging

Painter Apprentice

Canadian National	Canadian Pacific
Mixing	Elementary exterior work
Freight Car Painting and stencilling	Elementary interior work
Spraying	Stores. Colour mixing
Spray Booth Painting and varnishing	General exterior work
Rubbing Booth	General interior work
Glazing	Stencil cutting, design and lettering
Stencil Cutting	Varnish room
Transfer work	General freight painting
Sign Painting	General locomotive painting
	General coach painting

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*See page 8 re dieselization.

Photo: C.N.R.

An apprentice learns how to install electrical equipment in a passenger coach

Canadian National

Electrical Apprentice

Locomotive Wiring
Coach Wiring
General Maintenance Work
Battery Work
Armature Winding
Motor Repairs
Pole and Line Work
Electric Locomotive Maintenance
Diesel-Electric Locomotive Maintenance

Sheet Metal Worker Apprentice

Bench Work
Soldering
Brazing
Small Jobbing (Bench)
General Work – Freight Cars
Locomotive Lagging and Jacketting
Maintenance Work
Laying Out and Developing
General Work – Coaches

Pipefitter Apprentice

General Pipe Work on Locomotives
Air Piping on Locomotives
General Pipe Work on Coaches
Air Piping on Coaches
Copper Work
Brazing
Oxy-Acetylene Welding
Maintenance Work – Steam Fitting
Plumbing

Wood Machinist Apprentice

Canadian Pacific

Locomotive Department

Headlight Wiring
Turbo-generator headlight units
Armature and coil winding
General plant maintenance
Diesel locomotives
General repairs (motors, transformers and other electrical appliances)

Car Department

Generators, regulators, meters, thermostats, storage batteries, car wiring and air conditioning

Repairs in Tin Shop
Tinware and miscellaneous work
Soldering and light work
Sheet iron work
Plain and general work
Jacket experience
General tin and sheet iron
Helping tinsmith
Bench Work and welding
Roofing

Passenger Car Shops

Air brake, signal systems
Plumbing and kitchen piping
Water raising system
Gas equipment
Pipe bending and welding
Air Conditioning system
Heating systems
Freight car shops

Locomotive Shops

Track machinery
Tenders, locomotive
Feed water heaters
Stokers
Lubrication systems
Air brake systems
Copper pipe work
Trouble Department and Power House

Crosscut Saw
Dry Kiln
Tenoning Machine
Band Saw
Planer Matcher
Moulding Machine
Laying Out
Surface Planer
Buzz Planer
Mitering Machine
Rip Saw
Lathes
Filing and Setting Saws
Shaper
Machine Repairs

Canadian National	**Canadian Pacific**
Blacksmith Apprentice	
Steam Hammer	Hammer Operator
Light Forging	Help on light punch and shears
Forging Machine	Help on bulldozer
Medium Forging	Help on Bradley hammers
Electric Welding	Help on forging machine
Oxy-Acetylene Welding	Help on bull rivets and pneumatic hammer
Oxy-Acetylene Cutting Machine	Help on drop hammer
Tool Work	Help Blacksmith on light fires
Heat Treating	Punch and shears
Heavy Forging	Bulldozer light operator
	Welding and burning
	Forging machines operator
	Bull riveter and pneumatic hammer operator
	Drop hammer operator
	Light fire work
	General work

Only one of the shop trades is peculiar to the railways. The characteristics of the others are reasonably well known to the public generally.

The one exception is the trade of Carman, and the following particulars of this trade, as exemplified in the case of Car Inspectors, may be informative.

Car Inspector

The Carman, Car Inspector, or "Car Knocker" as he is sometimes called, fills a vital position in the organization. Upon his shoulders rests the responsibility for inspecting all rolling stock, except locomotives, as to good running order. Among his duties are the following:

1. To see that couplings are in good condition; that air, steam and train signal hoses are in proper repair. In a terminal he is responsible for the coupling of all these, and also the coupling of locomotives on to the trains.

2. Testing and maintenance of air-brake gear underneath coaches.

3. To make sure that all journal boxes on wheel trucks are properly lubricated in order to prevent "hot boxes".

A young man has two avenues through which to become a car inspector. He may take a carman's apprenticeship (five years) in one of the car equipment shops. After graduation he receives credit for two years seniority on the carman's seniority list, and then goes to work in a terminal. The carman then has the advantage of a good background of both theory and practice before he starts work in a terminal. The other avenue is to qualify through service as a carman's helper.

Promotions

Opportunities for promotion in the Operations Department are good for the young man who has the qualifications on which we have touched in this chapter: adequate education (at least two year's high school), leadership, organizational ability, a quick mind and willingness to work hard.

CHAPTER IV

COMMUNICATIONS

The railways, which need a telephone and telegraph network for the operation of their trains, have for a great many years been in the commercial communications business which, at the outset, was limited to the Morse telegraph. The communications branches are given a separate public identity from that of the railways owning them, being called Canadian National Telegraphs or Canadian Pacific Telegraphs.

Though Morse telegraphy, a code system, is still used in the operation of the railway itself, various machines operating at high speeds are necessary for the conduct of commercial services. Stock quotation services are carried across the country and printed at a hundred words per minute on stock tickers, which are leased to brokers and serviced by the company. The same equipment is used for conveying sports news. Teletype printers are employed to record news stories for the press. Radio programs are relayed and amplified over the wire systems of the telegraph companies. A description of the machines used and of their functions is given, at the end of this chapter. Many thousands of miles of wire and hundreds of teletype machines are leased to banks, brokerage houses, news syndicates and other business organizations. Eighty-five per cent of all telegrams are now sent and received on printing telegraph apparatus at high speed.

Employees of telegraph companies include *Uniformed Messengers*, *Counter-Clerks* and *Bookkeepers*, *Telegraph and Telephone Operators*, *Line Maintenance Men*, *Technicians*, *Mechanics*, *Salesmen*, and professional *Electrical Engineers*.

Training

The Canadian National gives classroom training for the positions requiring technical skills. Lectures and demonstrations using "live" equipment and some visual aids comprise the syllabus. Examinations are the determining factor prior to graduation to the job. Telephone operators and teletype operators are also trained, for the most part, in company schools.

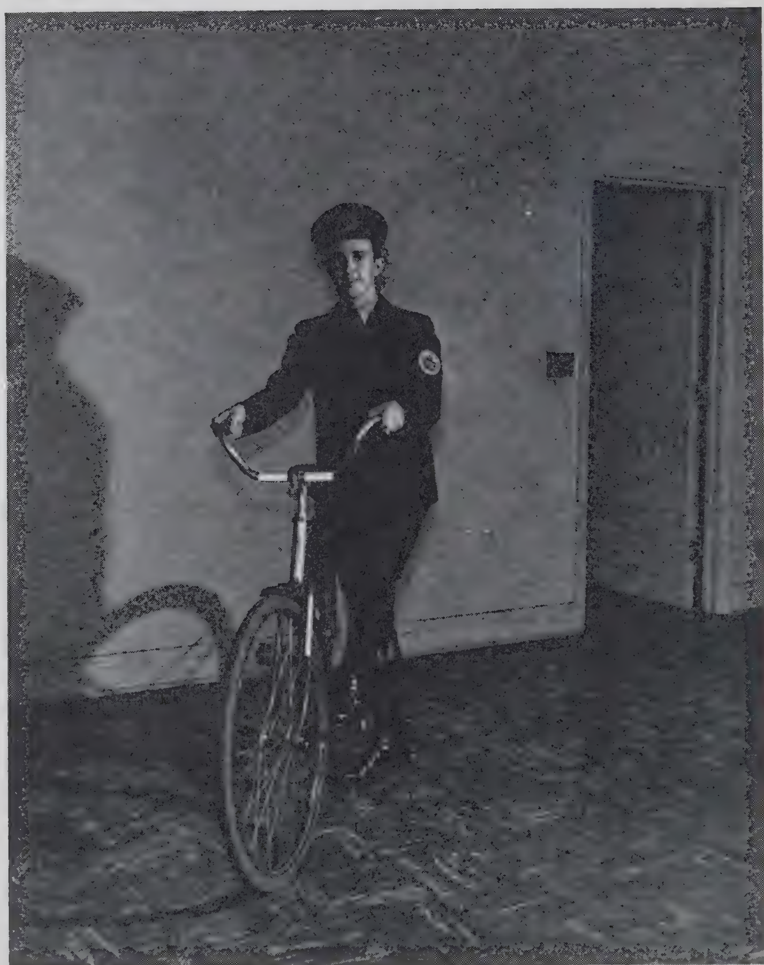
Photo: C.N.R.

Telegraph messenger

Exceptions would be found in the smaller centres, where there is training on the job. The C.P.R. training is on the job.

For the bulk of the remainder of the work-classifications, on-the-job training by departmental supervisors from prepared text is the established practice. This includes training for clerical work, and for "outside plant" or pole-line construction and maintenance as well.

Selection

The policy of the communications department is to promote from within the ranks. Promotion is based upon seniority, provided qualifications are sufficient. Only when there is not a sufficient supply of qualified applicants to meet requirements does the department go outside for help. However, this is a normal occurrence, and particularly in the spring of the year applicants from business colleges and high schools are screened before acceptance.

The greatest demand is for teletype operators, often obtained from the ranks of check clerks. Many of the maintenance forces, i.e., mechanics and equipment attendants, come up from the ranks. Employees are encouraged to prepare for promotion and are advised in this regard.

Machines used include:

Model 14 Teletype — A direct keyboard sending-receiving machine capable of speeds up to 61.3 words per minute, depending on circuit characteristics and the ability of the operator. Prints the incoming message on a narrow ribbon of tape.

Model 15 Teletype — Similar to the Model 14 in operating characteristics except that the incoming message is printed on a page, rolling from a continuous form.

Model 5-A Ticker — A 100-word-per-minute receiving-only printer used on stock-exchange quotation service. Prints on a narrow ribbon of paper tape from a typewheel. Glassine tape is often used, and the quotations projected onto a screen, in a translux projector.

Multiplex — Similar to teletype operation except that the transmitting and receiving positions are separately manned, and operated simultaneously. Transmission is from a perforated paper tape; reception is on a page blank. As many as eight sending and receiving positions operate from a single wire.

Photo: C.N.R.

A telegram has been received on a model 15 teletype

The bulk of telegram traffic is handled by "printerized" telegraphy rather than by Morse. "Printer equipment" is but another trade name for teletype and multiplex, and these are, in a sense, "electrified typewriters" connected together by wire, operating at speeds in excess of sixty words a minute. Transmitting operators, sending into these printers from distant terminals, punch a keyboard similar to that of a standard typewriter.

A knowledge of Morse is required by those aspiring to become *Wire Chiefs*, and all such personnel are promoted from within the ranks or after months of special training. A statement concerning *Plant Chief* (Communications Wire Chief) is given below:

Training — Trained by Company 8 to 12 weeks' course, combination of class-room and on-the-job training, weekly examination; entrance requires a good knowledge of basic electricity, the ability to send and receive Morse code (land-line) at approximately 20 words per minute,

mechanical comprehension and some mechanical aptitude; education the equivalent of 2nd year high school; paid while learning.

Principal Duties — The graduate Plant Chief is required to keep in the best practicable degree of operating efficiency the lines, circuits and apparatus in the assigned territory. He must have the ability to locate trouble in his testing and regulating room equipment and is required to make repairs and perform routine maintenance on same. He makes tests at stated intervals to ascertain if correct current values are maintained in various circuits operated within the testing territory and corrects abnormal conditions which such tests may indicate. He must be familiar in a general way with the wire layout and facilities of other companies with whom he may have to deal indirectly. He must be thoroughly familiar with approved methods of testing and locating faults and must keep such records of lines, wires and apparatus in the assigned territory. He issues instructions to linemen and others in the event of interruptions which will result in prompt restoration of service. He is responsible for the continuity and insulation of wires and is required to make tests at stated periods to detect abnormal conditions.

Working Conditions — Shift-work; 5-day week; covered by labour agreement; assigned vacations with pay according to the provisions of the agreement; graduated railway transportation privileges after 6 months Company service; not closely supervised but quality of performance reflected by trouble log reports; high degree of alertness required.

Academic Requirements — Not less than 2 years of high school and/or technical school studies; mechanical comprehension and mastery of elementary electrical theory is essential, as is the ability to send and receive Morse code (American "land-line" Morse).

Physical Requirements — Prefer younger men to take this training; minimum of physical effort required; normal vision and hearing; manual dexterity an asset; emotional stability coupled with high degree of mental alertness is required; schools usually set up in the late winter months.

Power Plants

Telegraph operation requires direct current, and each telegraph terminal makes its own by means of motor-generators and storage batteries, or other types of rectifiers and storage batteries.

Carrier Equipment

A form of wired wireless was introduced in the 1920's which permits one pair of wires to do the work of a dozen, thus economizing in the matter of pole lines in use. One carrier "pair" carries at any given moment speech (telephone) transmission, Morse, teletype, multiplex and stock ticker quotation services, without conflict. Exceedingly complicated, it uses vacuum tubes for transmission and reception, and is staffed by highly-trained men who communicate with one another, between carrier terminals, by means of Morse telegraphy.

Radio Amplifiers

Strategically spaced across the country, these repeat and strengthen the signals and pass them along to the next station or outlet.

CHAPTER V

EXPRESS DEPARTMENT

Just as the railways operate their telegraph services under organizations bearing individual names, so their express services are known by names such as "Canadian National Express" and "Canadian Pacific Express". These are self-contained agencies with their own Traffic, Equipment, Claims, Solicitation, Air and Foreign, Terminal and Train Service departments.

Their organization, following that of the railways themselves, is on a regional basis, with General Superintendents in charge of regions. Regions are subdivided into divisions, headed by Superintendents. Under Superintendents are Traffic Supervisors, General Agents, Agents, Train Messengers and their helpers, Train Value Guards, the many clerks and porters, the vehicle staff as well as the employees whose duties are listed below.

The activities of the express companies include transport by rail, road, water or air, of articles requiring rapid delivery. The variety of goods handled adds to the interest of this work.

Employees peculiar to this service include:

Porter: (**C.N.R.**) **Warehouseman:** (**C.P.R.**)	Loads and unloads express cars; handles traffic in the terminals for delivery to and from trains; may do some clerical work in connection with these duties, such as checking and preparing delivery sheets, and a wide range of other duties.
Motorman: (**C.N.R.**) **Vehicle Man:** (**C.P.R.**)	Operates an express motor vehicle on pick-up and delivery service of shipments.
Waybill Clerk:	Enters pertinent data on, and assesses correct charges to waybills. The waybill accompanies shipment to its destination point.
Clerk:	(Graded according to nature of duties) — Does regular office work including meeting the public, receipting for, delivering and keeping track of shipments; prepares accounting statements; performs a variety of other duties, depending on where he works.
Scalesman:	Weighs and prepares outgoing traffic for despatch to trains so that correct charges may be assessed.

Photo: C.N.R.

Express truck and despatcher

Train Messenger: (C.N.R.) Express Messenger: (C.P.R.) Travels on a route between two points where express traffic is heavy enough to warrant the department's assigning a man to handle this traffic; works on an express car checking, sorting, unloading and receiving shipments, and performing any necessary clerical work to ensure that the traffic reaches its destination safely and speedily.

Train Messenger Helper: Helps the Messenger with his work on a route where there is too much work for one man.

Express Agent: Many outstanding employees become express agents in a city or town. The agent is the department's representative there and, as such, has the responsibility of all his department's activities.

There is plenty of scope in the Express Department for the young man who is willing to work his way up, whose quality of work is good, and who is anxious to take full advantage of every opportunity to acquire as wide experience as possible.

The Express Department's policy is to promote from within the ranks to higher positions. The majority of male employees start from the initial position of porter, (warehouseman) and advance to positions that pay higher salaries and involve greater responsibility.

Applications for permanent appointments in specified positions not covered by wage contracts are encouraged. The selection of the successful candidate is made on a basis of fitness, ability and seniority. Preference is given to the senior applicant, provided he has the necessary qualifications to perform efficiently the duties of the vacated position. So, from the time a man enters the service in this Department, he has the opportunity to advance step by step to higher positions.

CHAPTER VI

HOTEL SYSTEMS

The two major railways in Canada both operate hotels, situated in the more important cities and tourist centres. Some of these are known to tourists of many lands, and are landmarks in their own communities.

Although the primary purpose of a hotel is the furnishing of lodging and food, these establishments have many other functions as well. Conventions, meetings, banquets, balls, concerts, lectures, exhibitions, entertainments and wedding receptions are among the activities which centre in the larger hotels.

Depending on their duties hotel employees are, to a varing extent, in contact with the public. They must therefore be clean, neat, polite, well-balanced, patient and reliable.

Hours may be irregular, but for many employees in the lower-paid classifications there are tips and also the ever-changing steam of humanity.

Educational standards for admission to hotel staffs are not unduly demanding. Average students having three or four years of High School training should pass the tests set. Avenues of promotion are open to all who show above average aptitude, initiative and ability.

In recent years it has become recognized that hotel management is a calling that requires executive talent, and that specialized training of a high order is necessary to develop Canadians aspiring to higher-level positions previously filled by Europeans. As a result, schools of hotel administration, such as that located at Cornell University, are training young men for futures as hotel executives.

For operating purposes a hotel is divided into departments, the principal of which are: Rooms, Food, Accounting, and Repairs, Maintenance and Engineer's.

The following details show the functions of each, and suggest the duties and opportunities for advancement for employees in various departments.

Photo: C.N.R.

Hotel room clerk and bell-hop receive travellers

Rooms Department (Front Office). Here guests make their first contact with the staff. Rooms are assigned, accounts prepared, information given, and mail handled. The entry position is Mail or Information Clerk. The line of advancement is to Room Clerk, Chief Clerk, or even to Assistant Manager or Manager.

Rooms Department (Service). Bell boys, Page boys, Porters, Elevator Operators, House Officers, and other employees who give direct service to guests, must be courteous and efficient. Able and intelligent workers in these occupations may rise to executive positions.

Rooms Department (Housekeeping). This is often the largest group of employees in a hotel. It includes Floor Housekeepers, Housemaids, Parlourmaids, Housemen, Linen room staff, and

Window Cleaners. Women usually enter as maids. Those qualified suitably may rise to Linenkeeper, Assistant Housekeeper or Housekeeper.

Food Department (*Stewards*). In this branch foodstuffs are ordered, received and distributed to the Kitchen. Employees include Storekeepers, Kitchen Stewards, Food Checkers and Dishwashers. Suitable workers may rise to Chief Steward and possibly to Managerial positions.

Food Department (*Dining Room*). Many of the workers in this branch are in direct contact with guests. Entry occupation is that of Tray Boy. Waiters, Captain Waiters, Head Waiters, Maitre d'Hotel, Catering Manager, are the other positions in line of possible promotion. Where there are cafeterias waitresses may be employed.

Food Department (*Chefs*). Vegetable Cleaners and Cook's Helpers are the beginners on this staff. Capable and teachable persons may receive promotion along the line Assistant Cook (several grades), Cook, Head Station Cook, Sous or Assistant Chef (several grades and specialties), Chef de Cuisine.

Accounting Department. The staff here is the usual clerical one, including cashiers, and auditors. It is headed by a Chief Accountant or Auditor. This department provides good promotional opportunities. Financial statements and statistical data are among its responsibilities.

Engineer's Department. This is staffed largely by skilled craftsmen, including engineers and firemen, plumbers, welders, electricians, machinists, and often the *Repairs and Maintenance* group of carpenters, painters, plasterers, polishers, etc. There are often opportunities for the labourers working in this department to learn a skilled trade as helpers.

CHAPTER VII

SLEEPING, DINING AND PARLOUR CAR DEPARTMENT

Most employees in this department are in close contact with the travelling public. A high standard of courtesy is required in the proper conduct of their duties, especially since, on longer runs, the same passengers and employees may be on a train for days on end.

There are three functionally separate groups of employees in this department. The largest group is engaged in road service; smaller groups are the office employees and the terminal employees.

Road service employees include those working on dining cars and those in the sleeping car and parlour car service.

Dining Car Employees — Initial employment in this service is as a *Pantryman* (C.P.R. 4th Cook). From this grade promotion is through two separate channels. A pantryman working in the kitchen may rise through the following positions: *Third Cook*, *Buffet Cook*, *Second Cook* to *Chef*. The alternative avenue of promotion is to *Waiter*, from which capable men can become *Stewards*.

Stewards must supervise the dining car crew and be familiar with all dining car operations; must deal with passengers in a suitable manner; responsibility for supplies and revenue is also attached to this position. Appointments as Stewards are not necessarily on a basis of seniority, and opportunities to take charge of a dining car first occur during heavy seasons of travel.

Sleeping Car Service — *Porters* have a somewhat limited field of promotion, but there are grades such as Porter-in-Charge which carry higher pay rates.

Sleeping Car Conductors are, in the C.N.R. service, generally speaking, promoted from positions in the dining car service. The C.P.R. generally fills these positions with new employees. They must have clerical ability, and have a full understanding of tariffs and of the operation of the sleeping car department. They must be able to supervise the porters on their trains. Appointments depends on merit and ability rather than on seniority.

OFFICE EMPLOYEES

In these services the same initial qualifications are required as those for other office employees in railroad employment.

TERMINAL EMPLOYEES

Terminal employees handle linen and supplies, and equipment of sleeping, dining and parlour cars. The entry occupations are

Photo: C.N.R.

Dining car galley

as *Linen Porter* (C.P.R. Linen Handler) or *Yard Porter.* Promotion is to Linen and Equipment Checkers, with the possibility of becoming Chief Linen Clerk, or Equipment Inspector.

Seamstresses are employed to repair linen.

INSPECTORS AND INSTRUCTORS

These titles describe supervisory positions. Experience in road service is therefore very important as persons performing this grade of work must have had the same practical experience as those they supervise.

PROPORTION OF EMPLOYEES IN VARIOUS CLASSIFICATIONS

Approximately ninety per cent of the workers in this department are road service employees; five per cent are office employees, and five per cent terminal.

Of the road service employees, about thirty-five per cent are sleeping car porters, thirty per cent waiters and pantrymen, twenty per cent chefs and cooks, nine per cent stewards and six per cent sleeping car conductors.

CHAPTER VIII

APPLYING FOR EMPLOYMENT

In large organizations such as the two major Canadian railways, the importance of securing suitable personnel has led toward standardized methods of selection. In this chapter we shall discuss recent developments in this field, first in the Canadian National Railways and second, in the Canadian Pacific Railway.

CANADIAN NATIONAL

Personnel selection along standardized lines has been developed in the Canadian National system since 1947. Employment Offices have been set up at Quebec, Montreal, Toronto, Winnipeg and Edmonton, and are to be established at Moncton, Saskatoon and Vancouver. Employment interviewers determine the suitability of the applicant, who is then sent to the employing officer of the department having the vacancy for a further interview and for engagement if approved.

Skilled mechanics and candidates for apprenticeship, however, must apply to the regional General Superintendent of the Motive Power and Car Equipment Department at Moncton, Toronto or Winnipeg, or to the Works Manager, Point St. Charles Shops, Montreal.

University graduates should apply by letter or personal visit, to the Personnel Department, Canadian National Railways, 355 McGill Street, Montreal. If they are engineering graduates they may apply, alternatively, to the Regional Chief Engineer at Moncton, Toronto, or Winnipeg, or the Chief Engineer, Montreal.

The procedure after application at employment offices includes:

a) Screening, using standard tests applicable to the position applied for, together with interview.

b) Referral to the employing authority where the vacancy exists, and acceptance by him if approved.

Photo: N.F.B.

The steam engine is giving place to the diesel-electric engine

Photo: C.N.R.

A diesel-electric engine.

c) Medical examination by a company medical officer.

d) Completion of staff forms and commencement of work.

Similar procedure applies in the case of applications to the Motive Power and Car Equipment Department by skilled tradesmen and potential apprentices.

Residents in cities where employment offices are located should apply in person. Residents elsewhere seeking positions in their own locations should apply fully in writing, or in person, to the local employing officer of the department in which employment is desired. If there is a vacancy, and the applicant appears to be suitable, transportation to the nearest employment office is furnished. If employment at the major centres named is desired by non-residents, they apply first to the local officer, or write to the Supervisor, Employment Office, Canadian National Railways, at the appropriate centre. In these cases transportation is not furnished.

It should be noted that the greatest concentration of employment of junior clerical staff is at system headquarters in Montreal and at regional headquarter offices in Moncton, Montreal, Toronto and Winnipeg.

CANADIAN PACIFIC

On the Canadian Pacific, a central employment office for the Montreal area was established in February 1935. At that time the Bureau dealt mainly with applicants for clerical positions, but later the scope was extended to include all classes of railway occupations.

In recent years, employment bureaus have also been established at Toronto, Winnipeg and Vancouver.

The procedure used in the selection of new employees is as follows:

a) A personal interview to determine the type of work in which the applicant may be interested and to secure details of the candidate's qualifications.

b) After an application form has been completed, mental alertness and aptitude tests are administered to secure a sample of the applicant's potential proficiencies.

c) Should the applicant's qualifications meet the requirements of an existing vacancy, the applicant is further interviewed by the Head of the office, or the Supervisor of the department in which the vacancy exists. Final decision as to the applicant's suitability is made by the supervisor.

d) If satisfactory, the applicant is required to undergo a medical examination by a Medical Officer of the Company.

At points other than Montreal, Toronto, Winnipeg and Vancouver, those seeking employment in positions other than mechanical trades should apply to the local Superintendent or Agent. Skilled mechanics should apply to the nearest Division Master Mechanic or Locomotive or Car Foreman. Candidates for apprenticeship are referred to the Superintendent of Motive Power at Toronto and Winnipeg or the Works Managers at Angus Shops, Montreal; Weston Shops, Winnipeg; or Ogden Shops, Calgary.

University graduates in mechanical engineering are invited to communicate with the Chief of Motive Power and Rolling Stock at Montreal, or the Superintendent of Motive Power at Toronto and Winnipeg. Graduates in civil engineering should apply to the Chief Engineer at Montreal or the Engineers Maintenance of Way at Toronto or Winnipeg.

It should be noted that during the first six months the new employee is on probation and is not considered to be a permanent member of the staff; at certain specified intervals his characteristics must be appraised by his supervisors and the results entered on a report designed for the purpose. The suitability of the employee for the job is thus tested without either party being committed. Should the experience be unsatisfactory, the man can seek other employment without acquiring any stigma of dismissal or without his service being recorded as "unsatisfactory". If fitted for some other type of work in the Company's service, he may be transferred.

Offices of the National Employment Service throughout Canada are in a position to assist all those who may be considering careers or employment of any kind with the railways.

CHAPTER IX

TRENDS

Railway employment has better-than-average stability, because railways constitute an essential public service which must go on, day and night, without ceasing. Without railways economic life would be paralyzed.

The railways form the backbone of the Canadian transportation system. No other form of transportation service can match the rail lines in completeness of coverage, north, east, south and west. None possesses the same quality of essentiality as the country's railway companies.

Today the railways are participating in Canada's industrial expansion. They are growing in line with the needs of a rapidly growing economy.

Within Canadian railways, technological changes are occurring which require new skills. Some of the newer types of work are being undertaken by present employees trained to perform new duties, but additional qualified personnel are also required.

For example, the continuing change-over from steam to diesel-electric motive power is affecting members of skilled trades whose work is chiefly concerned with steam engines. Included in this category are boilermakers, but the skills of this trade are now being applied to other types of railway rolling stock. To illustrate further, more electricians are required to service diesel engines than were required for steam engines.

Competition, although severe, does not seem likely to compromise the future prospects of Canada's railway employees. In some cases, competition creates more business for the railways.

CHAPTER X

STATISTICAL DATA

The following tabulation of the working force of Canadian railways is extracted from the publication "Steam Railways, 1951", issued in 1953 by the Dominion Bureau of Statistics.

EMPLOYEES FOR THE YEAR ENDED DECEMBER 31, 1951

Division	Average Number of Employees
GENERAL AND MISCELLANEOUS	
Executives, General Officers and Assistants	582
Division Officers	1,395
Assistant Engineers and Draftsmen	950
Other Miscellaneous Officials	1,526
Clerks	20,384
Telephone Switchboard Operators	265
Office Boys, Messengers, Attendants and Miscellaneous Trade Workers	1,955
Janitors and Cleaners	1,188
Total	28,245

MAINTENANCE OF WAY AND STRUCTURES

Bridge and Building Department Foremen	630
Carpenters and Bridgemen	2,703
Blacksmiths, Pipe Fitters, Plumbers, Tinsmiths, and Pump Repairers	429
Masons, Bricklayers, Plasterers and Painters	531
Helpers, B. and B. Department	484
Pile Driver, Ditching, Hoist and Steam Shovel Employees	847
Pumpmen	338
Extra Gang and Snow Plough Foremen	559
Signal Foremen	67
Section Foremen	5,998
Sectionmen	18,796
Labourers	9,091
Foremen Linemen	56
Telegraph and Telephone Linemen and Groundmen	69
Signal and Interlocker Maintenance and Repairmen	828
Total	41,426

Division	Average Number of Employees
MAINTENANCE OF EQUIPMENT	
General Foremen	101
Department and Gang Foremen	2,935
Blacksmiths	791
Boilermakers	1,525
Carmen	12,977
Electrical Workers	1,383
Machinists	5,843
Moulders	142
Pipe Fitters and Sheet Metal Workers	1,602
Helpers to Mechanics	10,735
Helper Apprentices	36
Regular Apprentices	1,956
Car Cleaners	2,148
Other Unskilled Employees	5,201
Unclassified Labourers	3,562
Stationary Engineers, Firemen and Oilers	872
Total	51,809

TRANSPORTATION

Inspectors and Sergeants of Police	224
Constables and Policemen	785
Storekeepers	270
Storemen	2,400
Train Despatchers and Traffic Supervisors	701
Supervisory Agents and Assistants	601
Stations Agents-Non-telegraphers (small stations)	136
Stations Agents, Telegraphers and Telephoners	6,299
Signalmen (non-telegraphers) at Interlockers	277
Foremen in Freight Sheds	582
Freight Handlers and Other Station Employees	7,869
Labourers	1,241
Dining Car and Restaurant Inspectors, and Stewards	336
Dining Car and Restaurant Helpers and Attendants	2,152
News Agents	185
Floating Equipment Employees	1,205
Sleeping and Parlour Car Inspectors and Conductors	237
Sleeping and Parlour Car Porters	1,367
Drawbridge Operators	100
Signalmen or Watchmen at Crossings, non-interlocked	580
Yardmasters and Assistants	725
Switch Tenders	386

Division	Average Number of Employees
TRANSPORTATION — Continued	
Hostlers	660
Road Passenger Conductors	847
Road Freight Conductors	2,775
Road Passenger Brakemen, Baggagemen and Flagmen	1,976
Road Freight	6,869
Yard Conductors and Yard Foremen	1,819
Yard Brakemen and Helpers	4,546
Road Passenger Engineers and Motormen	1,107
Road Freight Engineers and Motormen	3,826
Yard Engineers and Motormen	1,753
Road Passenger Firemen and Helpers	1,111
Road Freight Firemen and Helpers	4,248
Yard Firemen and Helpers	1,824
Express Department	5,258
Communication Department	9,082
Outside Operations	6,186
Total	82,545

The grand total of railway staff at the date of this report was 204,025. Female employees constituted about five per cent of this total.

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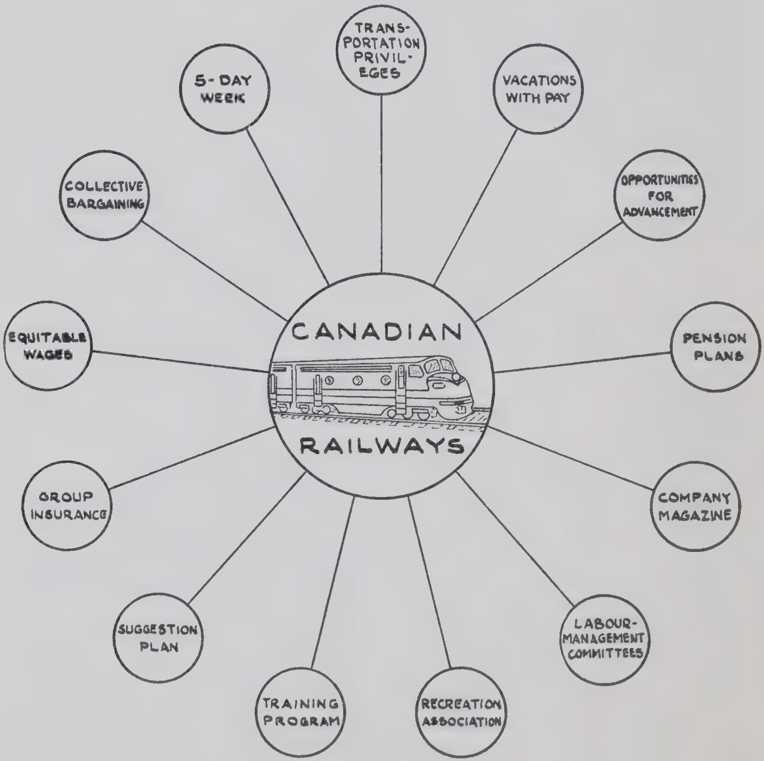
Department of Labour, Ottawa, **Wage Rates, Salaries and Hours of Labour in Canada,** (published annually).

Acton Burrows Company, Toronto 2B, **Canadian Transportation.** This publication, published monthly, gives brief biographical outlines of individual officials, especially dealing with their careers.

The publications of the major Brotherhoods and Unions. These are usually published monthly.

ADVANTAGES OF EMPLOYMENT WITH CANADIAN RAILWAYS



"CANADIAN OCCUPATIONS" SERIES

The monographs listed below, accompanied by pamphlets except in the case of numbers 12 and 13 have been published. Numbers 20-35 are in a single volume.

(1) *Carpenter*
(2) *Bricklayers and Stone-Masons*
(3) *Plasterer*
(4) *Painter*
(5) *Plumber, Pipe Fitter and Steam Fitter*
(6) *Sheet-Metal Worker*
(7) *Electrician*
(8) *Machinist and Machine Operators (Metal)*
(9) *Printing Trades*
(10) *Motor Vehicle Mechanic and Repairman*
(11) *Optometrist*
(12) *Social Worker*
(13) *Lawyer*
(14) *Mining Occupations*
(15) *Foundry Workers*
(16) *Technical Occupations in Radio and Electronics*
(17) *Forge Shop Occupations*
(18) *Tool and Die Makers*
(19) *Railway Careers*

Careers in Natural Science and Engineering: (20-35)

(20) "Agricultural Scientist"
(21) "Architect"
(22) "Biologist"
(23) "Chemist"
(24) "Geologist"
(25) "Physicist"
(26) "Aeronautical Engineer"
(27) "Ceramic Engineer"
(28) "Chemical Engineer"
(29) "Civil Engineer"
(30) "Electrical Engineer"
(31) "Forest Engineer and Forest Scientists"
(32) "Mechanical Engineer"
(33) "Metallurgical Engineer"
(34) "Mining Engineer"
(35) "Petroleum Engineer"

DEPARTMENT OF LABOUR

Economics and Research Branch

OTTAWA, 1954

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